JULY 1960 3.6

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

Hoffmann stay on the ball

Consultants—how to use them

How to run a punched card department

The Communications Problem

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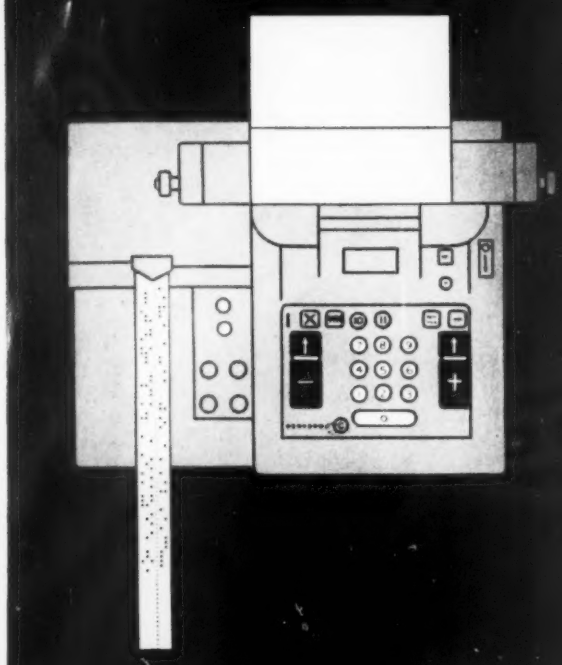
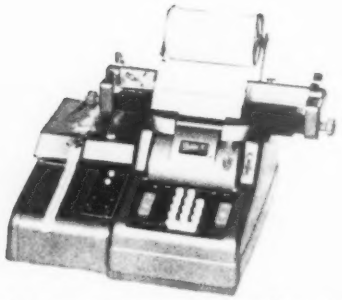
New ADDO-X units add punched tape to adding accounting





The addition of paper tape reading and punching units to ADDO-X equipment brings many computer techniques within your reach . . . enabling adding and accounting machines to form an integral part of tape-controlled data processing systems. These new units, which can be attached to models in the standard ADDO-X range, create new scope for business management in many fields of commerce and industry . . . producing punched tape as a by-product of adding and accounting operations, or converting tape produced at other sources into a comprehensive printed record.

In a recent banking installation an ADDO-X accounting machine, fitted with one of these units, was used on the processing of current accounts. It produced conventional documents *plus* punched tape for computer input. If the documented data agreed with that on the initiating vouchers then *the punched tape was bound to be accurate*; furthermore the ADDO-X eliminated the need for a punching staff and verifying equipment; both these points were made by the users themselves!

There is a complete range of punched tape readers, which have their own decoding units. The tape punch unit produces high accuracy 5, 6, 7, or 8 channel tape, and has its own scanning equipment, encoding unit, programme unit, and power pack. Amongst the many applications of these new units are: banking, insurance, stock control, invoicing routine, automatic machine tool control, automatic ledger posting, data verification, data collation, tape-to-card conversion.

If you would like to investigate the potential of ADDO-X data processing equipment in your own organisation, please write to: Bulmers (Calculators) Ltd., Empire House, St. Martins-le-Grand, London, E.C.1. MONARCH 7994. Branches throughout Great Britain.

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DIV

AUTOMATIC DATA PROCESSING

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CONTENTS

AUTOMATIC DATA PROCESSING

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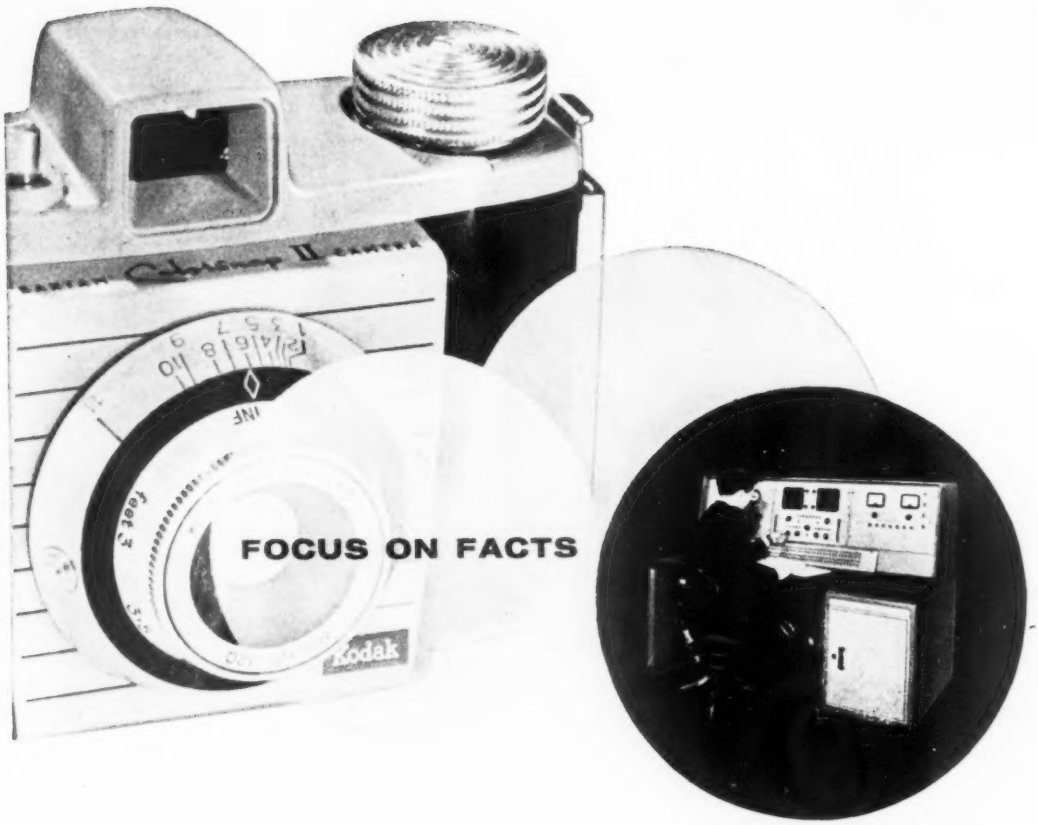

KODAK CHOOSE EMIDEC

Everyone knows Kodak, and the wide range of photographic goods they produce. It is not difficult to imagine the problem involved in maintaining an efficient production and distribution organisation.

To keep pace with an ever-growing demand, Kodak has now ordered an EMIDEC 1100 electronic computer.

Designed and manufactured by E.M.I. Electronics Ltd., the EMIDEC 1100 is a high speed computer, using transistor and magnetic core techniques.

Kodak will use the computer to maintain up-to-date records of stocks held at its nine wholesale branches throughout Great Britain. The EMIDEC will also print out invoices and maintain personal accounts and statistics for each of the organisation's 30,000 customers and trade outlets.

EMIDEC computers have been selected by many other large organisations and Government departments including:

AIR MINISTRY · B.M.C. · SAINSBURY'S · BOOTS BARCLAYS BANK · GLAXO · MINISTRY OF LABOUR ICI (PLASTICS DIVISION) · MINISTRY OF PENSIONS R.A.O.C. · B.E.A.

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EE96

Introspection

My dear White,

I am delighted to hear you have succeeded Tonge-Mitchie and that you are now installed in what must be one of the most attractive managing directors' offices in the country. Many congratulations.

You ask to be briefed on data processing—'not today's computer capers'—but on what will be happening tomorrow. This is characteristic of your Churchillian approach to business: 'let me have all the dope on one side of foolscap?' But if I pull your leg, I also admire your interest and take off to you my woebegone Homburg (yes, one of yours, *now*). I also wish more of your colleagues from the Belgrave Square club shared your curiosity.

Certainly, it sounds as if you have great plans afoot—doubling the shoe output, a new factory for the clothes make-up side plus the recent purchase of the Hatter's Company. And you ask a lot, you know.

If by 1967 your turnover has increased ten times (you sound very sure), then you will have long been in the computer class. Oh, I know you will tell me you already employ one of the monsters. But I don't merely mean putting a small electronic machine to work on hire purchase retail sales. That comes under the category of 'present-day computer capers.' Not that those capers won't be useful: when you get to be as big as you are already, the sheer volume of production and sales accounting makes you ripe for large-scale electronic data processing, and your people are looking into this.

I sympathise when you say that you have not inherited Tonge-Mitchie's leather chair to watch the disintegration of the managing director's control as the group expands, and your suspicion that computers might stop this rot is shrewd.

When you come to quiz your people on what they are doing probably they will talk about mechanising payrolls, producing invoices at phenomenal speeds and the like. Very impressive, you will think—but you need to have a few barbed questions in your quiver: are they looking into sales analysis (who sells what, when and how) inventory analysis, forward buying and forward planning? In other words there is a distinction between improving paperwork and providing information.

I remember you once explained that you stopped backing horses at Ascot because 'the crucial information was never available at the right time.' Well, data processing techniques applied to form might not give you the winner on a plate, but would probably throw up enough facts about a nag to make you decide whether it was a fair risk for your fiver. And maybe this is the sort of thing you are feeling for: an information system.

Fortunately, it is not for me to tell you how to set one up because there is no best way. Your experts when they come through their vigil of study will put proposals before you. However, there is one line of thought that I can suggest you adopt—I call it the introspective method. If you could decide what kind of information you need to deal with day-to-day as well as long term problems and put this down in a formal manner, and then asked—no, *ordered*—your various managers and their minions to do the same, these formal requirements would become the blueprint for your systems people to devise an information system exactly tailored to your needs.

Maybe, you could then go home at night with a clear desk, and we could go back to our Saturday arrangement of 18 holes before lunch.

Sincerely,

A.D.P.

The Bull 300 DP Series

(a fully synchronised unit system)

flexible, fast and expandable

Basic Elements	*Basic Speeds*
*Card Reader	300 cards per min.
*Card Reader Punch	300 cards per min.
*Arithmetic Unit	300 cycles per min.
*Printer	300 lines per min.
*Programme Unit	

All the elements are linked through the programme unit which co-ordinates the whole system and enables parallel processing of data.

Input-output speeds may be doubled by the addition of further units.

A second programme unit can be attached, increasing programme possibilities and enabling even further expansion of input-output units.

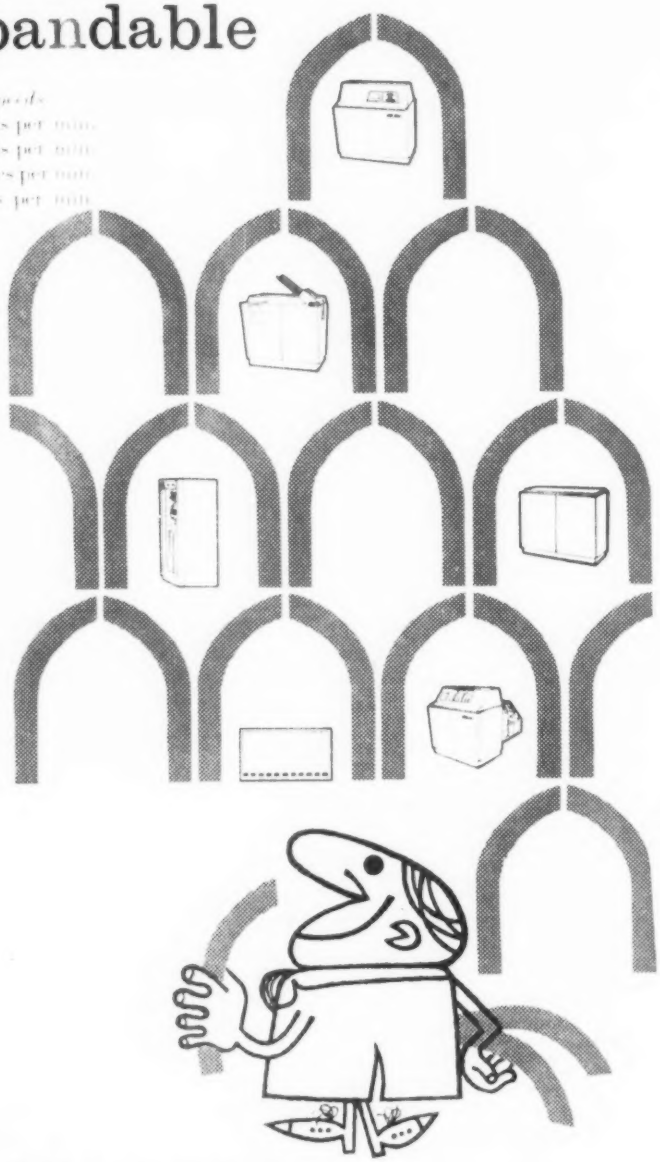
The 300 DP Series will expand [illegible] system with the addition of one or more of the following units, as required:

[illegible] 300 Computer
[illegible] Drum Extension
[illegible] Selector
[illegible] Magnetic Tape Units

[illegible] 300 Computer with [illegible] bring to the system the [illegible] of even faster arithmetic units together with storage [illegible] 200,000 decimal digits. [illegible] greater capacity be needed [illegible] eight magnetic tape units [illegible] added.

[illegible] integrated system is maintained with the addition of each unit to suit requirements. Here [illegible] Data Processing Equipment with the widest possible [illegible] of expansion which will be an asset to every organisation with data processing problems.

The first order has been placed for a large installation which is due to be delivered in the early Autumn of 1961.



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[illegible] Southampton Row - London W.C.1
Telephone: CHAncery 5725

DATA DIGEST

Renting Equipment

Ownership not important

Founded on the principle that if an organisation can have the use of machinery the question of ownership is not important, a new company started life last month. The Mercantile Leasing Company (parents: Mercantile Credit Company and the United States Leasing Corp. of San Francisco, if the Bank of England approve) is in business to lease to companies new machinery, equipment, fleets of cars etc—any capital equipment of a customer's choosing, including of course data processing equipment.

Freeing working capital, preserving bank credit for normal operating needs and beating the obsolescence problem are some of the advantages with which the company bait their hooks. Also rental payments count as expenses items and are allowable for tax purposes.

Mercantile's scheme means that

- companies specify their equipment needs (from one or many suppliers). Mercantile buy the equipment and a lease is arranged.
- total rent is determined according to the period of the lease. Leasing periods will usually be for five years. At the end of the basic lease period the renting company may continue to lease the equipment at a pre-arranged fractional rental.
- although the leased equipment remains the property of Mercantile, maintenance and insurance are the responsibility of the lessee.

Mercantile say that if a company is satisfied that equipment will pay for itself and produce a profit over, say, a five-year period then they will be granted rental facilities. They also stress that this is not a hire-purchase pay-as-you-use scheme, and that no option to purchase is given.

For companies on the brink of automatic data processing Mercantile's scheme provides one advantage: five years is just about the length of service that—in a growing company and in times of continually improving equipment and techniques—a data processing complex would usefully give.

At least two computer companies already make leasing arrangements, and with the growth of this kind of service future ADP installations may well be mostly rented.

Taping Policies

Computer for the Pru

Frequently climbing aboard the computer bandwagon these days are the insurance companies with their bulging portfolios of policies. Last month this column reported the clambering aboard of the Commercial Union Group of Companies—now it seems the man from the Pru has decided that a million and a quarter ordinary branch policies could best be maintained on magnetic tape. So the Prudential Assurance Company have ordered an Orion system and plan eventually to update on a daily basis the entire file of policies.

When the equipment will be installed and when the policies will begin to go on tape is nebulously forecast for two or three years hence; however the cost of the new system is rather more certainly established at £400,000.

Stable Talk

New machine available soon?

In the recently circulated reports and accounts for 1959 of Elliott-Automation Ltd. the chairman, Mr Rudolphe de Trafford, announced that E-A had been invited by National Cash (who market Elliott-built computers) to manufacture in Britain 'a very advanced NCR American-designed computer.' This is the first and only official news that the National-Elliott stable is trotting out a new machine. An informed source reports that this will be based on the American National 304 system, and it should have several unique features. For this system it is planned to develop and offer for sale a wide range of equipment so that the customer will be able to 'build up' his installation data processing brick by brick.

£1,000,000 in the bag

12 orders for new system

Already 12 organisations have put their names down for the new ICT system (the 1301—announced in this column last month) and the ICT claim that with these orders they will net over £1,000,000. It also implies that each organisation will be paying something in the region of £83,000 for their 1301 installations. Customers for the new system include two banks in Stockholm (who plan to automate their current account procedures as well as obtain general statistics), the Swedish electrical engineering company, Electroskandia (general accounting work, invoicing, and stock control) and the Australian company, Cadbury-Fry-Pascall Pty Ltd, whose 1301 will also be used for invoicing and stock control.

DATA DIGEST

British customers on the 1301 order book are:
British Railways (Eastern Region) Peterborough [for invoicing after transporting coal from pitheads to merchant's sidings, as well as producing traffic analysis statistics. Size of job: 100,000 consignments monthly to 8,000 dealers. Peterborough will later be a data processing centre for the Eastern Region].
Institute of London Underwriters [for centralised accounting, including advices of policies, and underwriting statistics].
Rubery, Owen and Co Ltd, the earth moving manufacturers of Darleston, Staffs [for production and material control].
South-West Regional Hospital Board, Bristol [for hospital accounting stores control and payroll].

Four other British customers are reticent about revealing their names — no doubt to avoid disappointing unsuccessful tenderers.

Truck movements

They called it Datamobile

The current sales vogue for fitting exhibition trucks and putting them on the road with a load of equipment broke new ground recently when in Rome last week IBM roaded a Datamobile [a bit of orange, grey and white with truck] which will do the Grand Tour of the major European cities during the next four months.

With an IBM 1401 data processing system tucked inside, the Datamobile will cross the English channel in time for the Business Efficiency Exhibition next October.

Meanwhile, though with less panache, an IBM 305 Ramac, rather like a poor cousin that can only afford to play the tourist in Britain, has been rolling into principal cities in a specially equipped vehicle, before being delivered to a customer in London.

Doing the Grand Tour
to educate others

Leo III

Beginning of a new reign

The annual statement of J Lyons and Co issued last month revealed that work on developing Leo III — an all-transistor successor to Leo II had reached the pilot installation stage.

John Pinkerton, who leads Leo's research department, says there is a continual stream of new circuit and constructional techniques, new magnetic-recording systems, new applications for circuit working in liquid helium etc — in fact no end of ideas.

'Some we are developing as fast as we can, the successful ones will no doubt see the light of day in later versions of Leo. My chief job is to spot winners.'

Meanwhile a stop has to be made at some point and the first production model of Leo III is expected in mid-1961.

Giant ordered

... and two satellites too

Due to be delivered early in 1962 to Esso Petroleum for general accounting work is an IBM 7070 system with seven tape units. In support will be two of the much smaller IBM 1401 data processing systems. Satellite one, comprising card reader and two tape units, will be used for completing card-to-magnetic tape operations, as well as for small routines; satellite two, with one tape unit, will be used as a high-speed off-line printer.

Leo's Pinkerton
He spots the winners

Data analysis

What Nimrod does

By 1962 National Institute for Research in Nuclear Science will need a computer for analysing and computing data obtained from NIMROD, the Proton Synchroton now under construction at Harwell.

By the time the institute's Rutherford High Energy Laboratory will have taken delivery of a Ferranti Orion system, complete with tapes and high speed printers.

Typeface hopes

Banks to opt

With only a few months left before the electronic sub-committee (how long has it been sitting?) of the London clearing banks pronounces on one of the three typefaces (and the magnetic ink recognition systems that go with them) for mechanised cheque sorting the manufacturers are both crossing their fingers and putting on the sales pressure.

Latest move in battle for the banks' patronage was engineered by EMI: they recently demonstrated their figure reading device (FRED) hooked up to a National Pitney Bowes cheque sorter.

Firing some shrewd shots to persuade, EMI claimed the type-

The Soviet Government asked Elliott Automation if they would exhibit a National-Elliott 803 at the British Scientific Instrument Manufacturers Exhibition held in Moscow last month. Also, would E-A take it by road? The company complied and a party and van (with suitable Russian inscriptions) set off on June 8—no doubt the 803 played suitable music *en route*.

In Moscow, the computer was a star attraction, attracted crowds around the small stand—'it looked like an antheap'—while E-A executives handed out 3,000 leaflets on the machine, and booked something like 60 potential orders—however, whether E-A will supply 60 machines in the end is doubtful. Still the trip must have been quite an experience.

face their system reads (based on a 'Broadway' typefront) makes very few demands on the cheque printing industry, and the machine does not need accurate spacing along a line or precise positioning on any printed character in relation to the leading edge of a cheque.

With its covers off LRLD *(above) looks uninspiring, and with the covers on it becomes a not quite unobtrusive grey box. It reads the typeface below and activates a National Pitney Bowes sorter.*

⁞654 123⁞30--7389⁞

27 ⁞132984619 10⁞

African venture

First Commercial Service

The chief asset of a new company—set up to provide the first commercial computer service on the African continent by Leo Computers and Rand Mines Ltd—will be a Leo III Computer (see Leo III above). By April 1962 the new company—Leo Computer Services (Pty) Ltd—will have installed in Johannesburg one of these new complexes at a cost of over £250,000.

Organisations of all types will be offered computing facilities by the Johannesburg bureau, and Rand Mines are already looking into the possibility of processing payrolls and stores records on the bureau's equipment.

Chairman and Managing Director of the new venture is F E Hays, manager of Rand Mines. Leo who are providing a bureau manager, chief operator and engineer, intend that, in addition to operating the new Johannesburg bureau, the new company will market Leo machines in South and Central Africa (including the Rhodesias and adjoining Portuguese territories).

Leo's Caminer and Hayes
partnership around a machine

Clarks CHOOSE **IBM** 305 RAMAC

RAMAC—[illegible] RANDOM ACCESS METHOD of ACCOUNTING AND CONTROL [illegible] complete data processing system with a difference. It allows transactions to be processed as they occur and in any order. Preliminary punched card handling is cut to a minimum, and all the 50,000 100-character records stored in RAMAC can be maintained with up-to-the-minute accuracy.

All this makes RAMAC the ideal system where thousands of individual records have to be kept up-to-date and cross referenced. Integrated invoicing and stock control, hire purchase accounting, production scheduling and banking records are just some of the applications where RAMAC is already proving its superiority to other methods of data processing.

In Britain the first IBM 305 RAMAC is already working for C. & J. Clark, of Street in Somerset. As Britain's largest and most fashion-conscious shoe manufacturers, Clarks employ over 6,000 people in their West Country factories alone, where they produce over 35,000 pairs of shoes *each day* in a variety of styles, colours, sizes and fittings. Clarks use their IBM 305 RAMAC to control this stock and cope with the thousands of orders they receive each day.

Other companies soon to follow Clarks in installing the IBM 305 RAMAC are:

The Book Centre—*Invoicing and Stock Control.*

Scottish Midland Guarantee Trust—*Hire Purchase and Financial Accounting.*

Caterpillar Tractor Co.—*Invoicing and Stock Control.*

IBM UNITED KINGDOM LIMITED · ROYAL LONDON HOUSE, 48-54 WEST NILE STREET, GLASGOW C1 · TELEPHONE: CENTRAL 8461

CHC66A

A.E.I. Hotpoint Ltd.—*Stock Control and Production Planning.*

Joseph Burton Ltd. (retail grocery chain)—*Invoicing and Stock Control.*

Dorman Long—*Production Scheduling, Invoicing and Stock Control.*

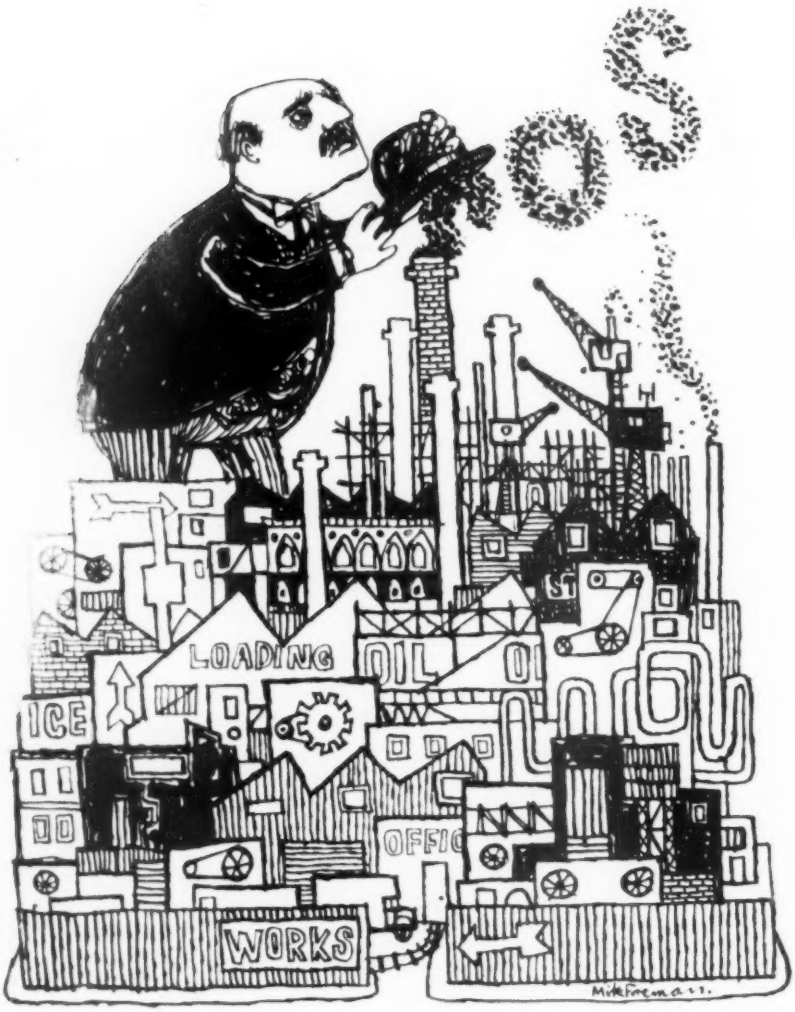
HALF A SECOND! That is the average time it takes to pick out any of the five million alphabetic or numeric characters of business facts in the IBM 305 RAMAC disc storage file. RAMAC can also be supplied with ten, fifteen, or twenty million character capacity disc storage. Each minute 125 punched cards can be fed into RAMAC while it can print up to 150 lines, punch one hundred cards and type 600 characters at the same time, in addition to its normal arithmetical and logical functions.

YOU CAN SEE THE IBM 305 RAMAC IN ACTION IN GLASGOW at the Royal College of Science and Technology (Room 53) George Street, C1—from July 18th to August 12th.

LONDON at the IBM Data Processing Centre, 101 Wigmore Street, W1—from August 22nd to September 30th.

HEAD OFFICE: 101 WIGMORE STREET, LONDON W1 TELEPHONE WELBECK 6600 · *Electric Typewriters* · *Data Processing* · *Time Systems*

The Communications Problem



Laura Tatham

—*and some solutions*

The computer has thrown up the possibility of rapid and precise central direction and control of most business activities—but one problem remains: getting the information in the right shape where it can be used. Developments in the new field of 'data transmission' suggest the problem will quickly disappear

DEVELOPMENTS in automatic data processing closely parallel those which took place in the past as a result of business activity. Just as the telephone was evolved to fill the need for instant person-to-person communication over long distances, so the increasing complexity of business organisation and strong inter-company competition have produced a demand for more, and more swiftly available, information of all kinds hence the electronic computer.

Now comes the next logical step: systems which allow machines to communicate directly with one another over telephone or other wires with a minimum of human intervention. This development is inevitable. The cost and bulk of electronic data processing systems has led to the centralisation of information-producing operations. Unless a fast system, using a minimum of labour, is found for transmitting information from the perimeter to the centre of the communications web, much of an electronic system's potential for producing precise information at high speed is wasted.

The size of the web may vary. In some instances it embraces only the immediate surroundings of the computer installation a group of factory buildings, perhaps. In others, it may extend over the length and breadth of the country. Already there is some equipment available in this country for originating, sending and receiving data over long or short distances and other more sophisticated equipment will be available soon.

In Britain communications sooner or later involve the Post Office, and the GPO is conscious of the businessman's new needs. In addition to its already well known Telex service, it is now offering facilities for transmission of other than the standard teleprinter code used over Telex circuits. It is also throwing open the normal public telephone lines for the automatic transmission of any type of data which the limitations of these circuits allow, though any equipment used must receive GPO approval. The Post Office will rent out modulator units which 'translate' serial pulses emitted by the reading equipment into a suitable form for transmission by telephone lines and, at the receiving end, reconvert them to machine language. No announcement has been made about charges. But, with subscriber trunk dialling in the offing, it is difficult to see how differentiation could be made between the cost of speech and data transmission calls.

In practical terms, the situation now is that any company can avail itself of inland public telephone and Telex lines to transmit data from point to point direct from punched cards, perforated paper tape, or even magnetic tape. Private telephone and telegraph lines with similar facilities are available for those with a sufficient volume of traffic to justify their cost.

Transmission speeds will vary from 50 to 2,000 bits per second, the code employed by the user determining what this means in terms of characters per second. For speech-type lines error

detection equipment will have to be supplied by the user himself.

On inland Telex equipment (Telex is an international service), users will be able to employ codes other than the standard telegraph alphabet to which they have previously been restricted. The Post Office will rent, for a sum estimated at £50 to £100 per annum, error-detecting equipment working with 5-unit codes at 50 bits a second which, by reducing the error rate from the present average of 1 in 40,000 transmitted characters to as low as 1 in 1,000,000 in some instances, will provide a much more reliable system.

How will the user determine which system to use? The answer depends on two factors: the type of equipment which will prove most useful to him, and the volume of traffic. Though the speed on teleprinter lines seems pathetically pedestrian compared with the 10-times-greater telephone transmission rate, the teleprinter circuits are less expensive. In many cases, where information is fed from relatively small branch offices inward to a central point, high-speed transmission would be totally unnecessary. At the other end of the scale, circumstances may justify a company adopting the fastest and most expensive system of all—magnetic tape to magnetic tape transmission. Such systems are expensive because their use demands a much larger share of the total width of the 'band' on which data or ordinary conversation are carried, thereby depriving other users of a reasonable proportion of the line 'space'. The only circumstances which could justify their use are to be found in research organisations, with research centres scattered over a wide area, and where large volumes of recordings are made by analogue or small digital computing systems and where these have to be fed immediately to a large central computing system to obtain the results which would allow work to proceed uninterrupted. A set-up of this kind would probably effect substantial savings over the alternative method—installing a large computer at each research centre.

Systems in Britain

Several transmission systems are already available in this country and some are already in use. Apart from those using teleprinter circuits, which operate on a private or public line basis, there is the IBM 065 and 066 Data Transceiver system, designed to exchange information on punched cards over long or short distances; the same company's 357 network system is designed for use within a building or group of buildings. Other systems based on transmitting the information on punched cards (though not of the tabulator type) are the Ferranti Transacter and the Friden Collectadata (the latter can use 8-channel paper tape or edge-punched cards and is designed purely for internal use). Shortly available will be the Ericsson Digital Data Link which in its standard form is capable of transmitting data from 5-channel paper tape in any code over speech-type lines and can be provided to accept other forms of input than paper tape.

The Data Transceiver

The IBM 065 Data Transceiver comprises an adapted version of an ordinary card punch, to which is linked a 'black box' which translates the information into a code suitable for use on a telegraph or telephone circuit. The 066 model includes a print-out facility which renders, in clear, the alphabetical and numerical contents of all or some of the card columns along its top edge. The equipment is designed in such a way that four sender-receiver pairs can operate independently over the same telephone line.

Transmission is largely automatic, once communication has been established between transmitter and receiver, a mutual okay given and both machines switched to the 'on' position. Cards are stacked in the transmitter's hopper, and read at a rate of up to five cards per minute on a telegraph line, or twice as fast on a telephone circuit. As each card is read, the machine stacks it in sequence in a receiving tray.

At the receiver end this process is reversed. Blank cards are fed automatically into the machine and punched according to the signals received from the transmitter. Finished cards (with printing along the top if an 066 model is used) are carried away and stacked in a receiving bin.

Magnetic tape to magnetic tape transmission, though likely to be expensive, might well provide a breakthrough for the research organisation with scattered centres each producing volumes of data

Belling-Lee's system of shipping information between London and Liverpool means that card equipment is not duplicated and factory operations can be closely watched

The equipment detects errors in initial punching or transmission.

The format of the punching is determined by a program card which is wrapped round a drum in the transmitter and receiver machines before transmission begins. This program instructs the transmitter which columns to read and the receiver which columns to punch. The two programs need not be identical but must, of course, be compatible.

Remote Factory Control

One company which is at present using IBM 066 Transceivers is Belling-Lee, the electronic component and TV aerial manufacturers. The machines form part of a complex, which includes an IBM 628 electronic calculator and 421 tabulator hook-up, on which a completely integrated production control, stock control and machine loading system is run. The transceiver network was in fact incorporated into the complex from the beginning.

Belling-Lee have two transceivers, one at their head office and factory at Enfield, London (where the central accounting is done), the other at their factory in Liverpool. Data from the Liverpool factory are processed at Enfield so far as production, stock and machine loading is concerned: the transceivers are therefore used for transmitting 'instructions' on punched cards from Enfield to Liverpool, and for receiving daily progress reports from Liverpool.

Transmission time at present occupies about three hours a day. In spite of this, the company has found it worth while to rent a private GPO telephone line at a cost of £2,000 per annum. A switching device alongside the Enfield transceiver allows the operator to get straight through immediately to his opposite number in Liverpool. For two hours each day the line is switched to the 'switchboard' position, which makes it available to other members of the organisation. The company reckons that £250 a year in trunk call charges is saved by the private line; and have, in addition, been able to give up one of their three teleprinter links which give a further saving of £700 a year.

Actual transmission time varies according to the type of work done. In one type of transmission where all the columns of 80-column cards are read, speed is 10 cards per minute. For a second type (which involves several skips of unwanted columns) speed reaches about 15 cards per minute. Stock balance card transmissions, which involve punching at the receiving end only a date, part number, classification code and quantity, take place at a speed of 20–21 cards per minute.

The system has now been working for just over a year, and is found entirely satisfactory. The Post Office gives a good service, so that in the event of line breakdown service should be restored within an hour or two. The transceiver system is not yet running to capacity and will, within the next two to three months, be working for six to seven hours per day instead of the present two to three.

The IBM 357 Data Collection System

This system, which has only recently become available in this country, is designed for purely internal communication. It provides a network of reporting stations which, by means of punched cards, provide a constant flow of information from, say, a production line to a central computing installation.

The system comprises any number of input units, up to 20 of which may be connected to each output station. Input units may be situated up to one cable mile away from the outputs. There is also a control unit which, in a way comparable to an automatic telephone switchboard, governs the sequence of transmissions from the input stations; it also selects the information required to be punched at the receiving end.

Output stations are similar in design to the maker's standard time clocks. Into these, employees feed *pre-punched* cards. The first card identifies the worker; the second, which travels with the part or assembly, identifies the material on which he has performed the work. There is a keyboard on which the employee can enter up to 12 columns of variable details.

At the receiving end a card, not necessarily in the same format as the input card, is punched out, the date being inserted automatically. The 357 instruments can utilise all columns of an 80-column card if required.

What it costs to hire lines for automatic data transmission equipment

TYPE OF LINE	ANNUAL CHARGE	EQUIPMENT CURRENTLY APPLICABLE
Telegraph (telex)	£160 (inc. hire of teleprinter) upwards depending on terminal apparatus; plus call charges	Teleprinters and range of paper tape equipment
Telegraph (private)	£12 per radial mile for first 25 miles reducing to £2 per mile up to 75 miles, £1 10s. up to 200 miles and £1 per mile for distances over 200 miles	Teleprinters and range of paper tape equipment. IBM 065 and 066 Transceivers
Telephone (private)	£12-£18 per radial mile, depending on requirements	Ericsson Digital Data Link* IBM 065 and 066 Transceivers Ferranti Transactor*
Telephone (public)	£56 per exchange line, plus call charges	Ericsson Digital Data Link* IBM 065 and 066*

* Not yet approved by GPO

* Not yet approved for public telephone circuits

Reporting on Three Cars a minute

[illegible] Volkswagen works, Wolfsburg, Germany, [illegible] system is working very satisfactorily. The [illegible] the production control operation can be [illegible] by the fact that 180 cars roll off the [illegible] on line each working hour.

[illegible] before installing the 357 system the company [illegible] pre-punched card for each car, containing [illegible] the pertinent details except the motor and [illegible] chassis numbers. This card followed the vehicle [illegible] the assembly line; the chassis number was stamped on the card as the body met the chassis. The engine number was written on the card by hand when the motor was mounted. At the end of the assembly line the card was handed to a controller.

Every hour a messenger collected the cards and delivered them to a special department where the written and stamped details were key-punched into them. Despatch documents and bills were prepared from these cards, so that any errors in manual recording at the assembly line were automatically transferred to the documents. These errors resulted in loss of time when the customs authorities rejected a car's papers; and a good deal of time was wasted in transporting and key-punching the cards.

Now, using the data transmission system, three pre-punched cards are used for each car. One, punched with the chassis number, follows the chassis; a second one goes with the motor; the third contains all the other details. At the end of the assembly line, the controller takes all three cards and inserts them into the 357 input station. At the output end, the data on all three cards are combined into a single card which is ready for immediate processing.

The new system eliminates both errors and waste of time.

The Friden Collectadata System

Also intended for internal use is the Collectadata system recently introduced in Britain by Bulmer's. It consists of a network of readers (input stations) several of which are connected to each output punch on a cable-sharing basis. Only one transmitter in each group can work at a time, however.

Continued on page 42

How to Run a Punched Card Department

Malcolm Ross

Like the directors of a public company a punched card department manager must be able to give an account of his stewardship. To do this he needs to know *precisely* what is going on in his department.

MOST companies are in business to produce and sell products—cars, petrol, furniture, etc—and certainly not (with some obvious exceptions) to produce documents and reports. This is a fact that those concerned with accounting and punched card departments do well to remember. To say this, of course, is not to belittle clerical and reporting work, but to put matters into perspective and to stress the interdependability of production, sales and clerical tasks. A punched card set-up does have a key rôle in many companies, and the first notion that must be firmly grasped is that a data processing installation should be laid out and planned as you would a production line: a company is not in business to produce reports, yet a data processing manager is (this does not mean he has to wear blinkers), and he looks to source documents as the raw material and the final report as the finished product.

A punched card installation should be established as a service department, or, if you prefer—a clearing house—for the whole organisation and made to operate on a clearly established budget with the onus of explaining where its money goes. Some card installations—particularly small installations—are considered as clerical departments set up to do one job; for example, to prepare a payroll. This may be permissible in small companies, but quite often one discovers companies that have expanded considerably in short periods with two or more (often incompatible) sets of card equipment used for different jobs: the equipment has been purchased on behalf of one or another clerical department to provide a solution to an *ad hoc* problem. Each clerical unit has been allowed to organise itself in an insular manner, so that investment in equipment (or hire charges) are much higher than they should be. So any idea of treating a data processing installation as yet another clerical department should be discarded.

As a service department, a data processing installation should have three very obvious qualities:

it must be as economic to run as possible

it must be efficient

it must provide fast and accurate service (late reports are useless, inaccurate reports—or invoices—are harmful)

Administering

How economy and efficiency in a data processing department will be achieved will obviously vary from installation to installation. Equipment costs may be high in some instances because duplicate machines are kept in case of breakdowns; in some installations the labour costs may be high because machine operators are hard to get and hard to keep. However, in every case—once the extenuating circumstances have been recognised—some method is still required to gauge the efficiency of an installation (and to do this continually) and to value the service it provides.

Yet this is not always obvious. When an organisation adopts data processing equipment for the first time, a clear economic case is usually given for the change (it may be a change from a manual or even a keyboard entry system), but once an installation has been in existence for some time, taken on additional applications, acquired new equipment and runs the occasional extra shift, it would appear that less attention is paid to the economics of running it.

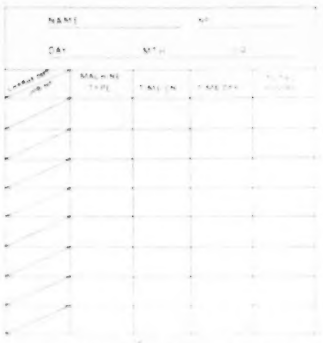
THE INTERNAL PROCEDURE

With equipment to hand the job of keeping an eye on machine costs and labour expenses can conveniently be done on the equipment particularly as it will not normally take up much time. Key to doing this is perhaps a time sheet which operator should be filling the data for these are the source documents for controlling a punched card department.

An internal procedure should be established and, as part of this, all reports produced in the department should be coded (numbered); a four digit code could be used to indicate the job number and a suggested grouping is as follows:

000/1 Payroll
100/1 Sales Statistics
200/1 General Accounting
300/1 Inventory Control
400/1 Spare
500/1 Labour Distribution
600/1 Material Expense Distribution
700/1 Spare
800/1 Spare
900/1 Administration

The above would give 99 jobs within each application and 9 sub divisions within each job.



In addition a three digit card code could be used for indicating the type of transaction or job done (*ie.* punching) the first digit to tie in with the first digit of the job number: in other words all zero hundred cards belong to the payroll application and so on.

The work of a punched card department should be controlled from three aspects: the hours the operators work (operator utilisation) the useful machine operating time (equipment utilisation) and the cost that each particular job entails.

In order that these controls be achieved, each operator should record daily the times she has worked on various jobs on a daily time sheet. (A specimen time sheet and some notes on actually having a punched card routine for administering a department are included in the box above.)

Operator utilisation

Normally all card installations are staffed by two types of operators (some installations occasionally have further 'divisions of labour') —punch room and machine room operators.

Normally punch and verifier operators an overall average output of 160 cards punch an hour (seven hours a day five days a week) should be expected. This average —which applies to a trained operator would include 'dead work' such as punching every column on a master card. On peak load days the output should be far above 160, and on off peak days when there might be an element of idle time the output would come below the figure of 160 an hour.

Individual records of each punch and verifier operator's performance should be kept and compared against standard, and from these records a monthly volume should be established of all cards prepared in the punch room.

Once this figure is arrived at, it should be possible to check whether the punch room is over —or under—staffed as follows:

The actual units (*ie.* cards punched) divided by the number of working days will give the number of units produced each day.

$$\frac{\text{actual units}}{\text{working days}} = \text{units per day}$$

and the number of daily units divided by the 'daily factor' (1120 is the expected daily output from each operator) will give the standard number of operators required.

$$\frac{\text{units per day}}{1120} = \text{no. of operators required}$$

This can be compared to the actual number of punch staff employed and will provide a good indication of whether the punch room has a shortage or a surfeit of operators. At the same time this control throws up the number of operators required for each application, and should help the data processing manager to forecast his future requirements by taking into account the number of working days and the anticipated volumes he will have to contend with.

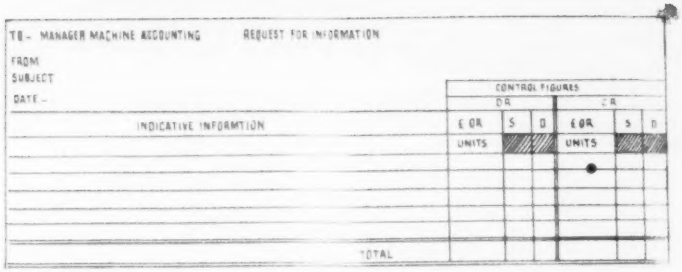
When assessing machine room operators to gauge the work they do, a ratio should be used of one and a half machine hours to one operator hour; thus an operator working a seven-hour day should be able to account for 10½ hours work in machine hours. At this point it should be mentioned that each machine room operator should see a routine job right through to its completion; so operators must be capable of handling all of the equipment in the installation. If they make mistakes or lose time, then it should be their responsibility to make up any time lost and meet their schedules.

The basis of the manpower calculation there is:

There are quite a few anomalies which are difficult to anticipate, some of the common ones are listed below, it is suggested that they be coded in the 900 series of job numbers.

Idle time
Sick
Holiday
Time off in lieu
Development
Maintenance
Clerical
Equipment other than data processing
Supervision
Re-run machine fault
Re-run operator fault
Administration

The last remaining item is the request for non recurring information, such as the detailed listing by invoice number, in order that discrepancies be investigated or a one time only job. This should be covered by a request for information form on the lines indicated above and this document should only be originated by the serviced department on that particular application.



The installation should be completely covered and any job being processed on the equipment should be covered, either by a job number which must be quoted in the current operating procedure or by a request for information.

A point here is that a job for a company department should only be charged for once, so if the job has to be re-run, due to a machine or operator fault, the machine accounting department should take the second charge. This charge would eventually be prorated back over all the applications.

$$\frac{\text{total machine hours}}{\text{working days}} = \text{machine hours per day}$$

then

machine hours per day × daily factor (10½) = standard number of operators required.

Compare this figure with the actual and once again this should throw light on the number of operators employed.

This ratio, of course, refers to the overall staffing of the machine room. In actual fact the ratio will vary from 1.3 to 1.8 machine hours to an operator hour depending on the application worked. Payroll has a high incidence of machine usage.

Equipment utilisation

From each daily time sheet entered by the machine operators (see box above) a card should be punched and verified which shows the chargeable department, the job number, the type of machine and the hours worked on it. From these cards it becomes possible to ascertain the total number of hours run by each type of equipment (or even by each individual machine if required) during the month. Then by taking the daily available hours and multiplying them by the number of working days in the month, it should be possible to arrive at a total availability, again for each type of equipment for the month.

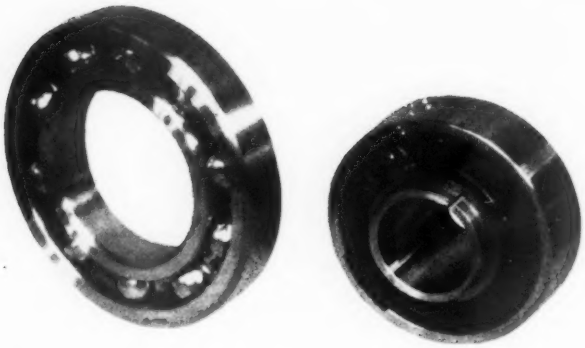
The total of running hours when broken out under three main headings (work for company departments, own administration and maintenance) should give a picture of equipment utilisation for the month. So by deducting 'equipment utilisation' from the total availability figures, it can be seen whether in fact an installation has any spare capacity. This procedure should throw up the information that work for the company departments takes up of course, the largest slice of the available time, that the administrative run is reasonable, and that the preventive maintenance takes about three per cent of the total.

The cost of each job

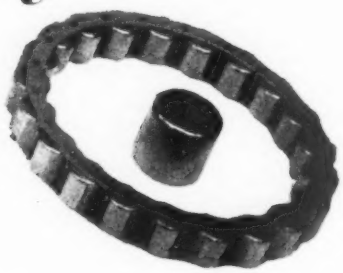
If punched cards are prepared from daily time sheets, then it is possible to sort these 'administration cards' by job numbers and chargeable departments. By splitting the cards into two packs —punch room and machine room—the amount of hours charged to each job, by each type of equipment, with an over-all total for each company department and a final total which shows over-all utilisation (this, of course should tally with the machine utilisation report).

Whether an installation's card equipment is purchased outright or rented, it is possible to arrive at an hourly cost figure for each type of machine; this is more obvious in the case of rented equipment where the monthly rental of a machine can be broken down firstly to give the weekly rental figure and then an hourly figure. Hence the hourly rate for each machine, multiplied by the hours charged above should give an 'equipment cost distribution' in pounds—how much the costs of running the installation are incurred by the company departments, administering the installation (for this purpose maintenance would come under this head) and by having spare capacity.

This information added to the labour costs, and other operating expenses—such as the cost of stationery cards, light space, etc—give a basis for charging departments for work done.



Hoffmann stay on the ball



... with a production control system that tells them where their components are, and in what stage of manufacture and assembly. Manufacturers of ball and roller bearings, Hoffmann have recently [illegible] to a system of unified records and 'data capturing' from copies of these records. Result: they have reduced four jobs to one routine

PRODUCTION control so easily becomes an administrative Cinderella. Because of difficulties in obtaining the right data at the right time, the planning and control of manufacturing tasks may be done with less precision than the firm's commercial routines. The result is that *ad hoc* decisions affecting the whole factory have to be made by workshop supervisors who are intimately concerned with only one part of it; while control is largely a matter of holding inquests after things have gone wrong.

Progressive firms recognise these shortcomings and are doing much to remedy them. Often this involves some degree of mechanisation. But here the incentive to mechanise goes far beyond the prospect of saving clerical effort.

The real object of the exercise is to make better use of the firm's resources in plant, material manpower and capital, and consequently to offer customers a more competitive service.

This is certainly the motive behind the unusually efficient production control system which has been developed during the past few months by the Hoffmann Manufacturing Company, Chelmsford, one of Britain's leading manufacturers of ball and roller bearings. Determined to inject into their administration the precision which already distinguishes their products, Hoffmann have integrated four jobs which, although based on the same original data, were done separately in the past:

1. Controlling the progress of thousands of different components through the various stages of manufacture.
2. Matching current production plans to the daily inflow of orders, and seeing that stocks of the firm's standard bearings are kept at predetermined levels.
3. Getting accurate valuations of work-in-progress for the monthly accounts.
4. Getting accurate figures for the firm's costing system, which is based on the use of standard costs.

In the past, most of this work was done manually. Now it is wholly mechanised and to a large degree automatic. Day-to-day records of work-in-progress movements are produced by a

battery of direct entry accounting machines; valuations and various statistical jobs are done on an 80-column punched card installation, employing a small electronic computer.

The two types of equipment are, however, linked by an automatic 'data capturing' system. Electrically coupled to each accounting machine is a small unit which extracts some of the information recorded during the keyboard operation and punches it into 5-channel teleprinter tape. Afterwards, the tape is converted to standard punched cards, which are processed on the computer and the ancillary electro-mechanical equipment.

The conversion is automatic. Therefore, the system achieves full integration in the sense that everything stems from a single recording of original data, eliminating unnecessary work and reducing the errors which easily occur when data has to be transcribed from one form to another. Moreover, the one and only keyboard operation is, itself, productive. It provides visible records which can be referred to or acted on immediately; and through the use of ordinary machine accounting checks it simultaneously verifies the information which is to undergo further processing.

After using this system for about nine months, Hoffmann have found that it produces substantial benefit. A central records department has taken over the clerical chores which were previously done piecemeal on the shop-floor. Three sets of records have been compressed into one, from which the current production orders position can be assessed at a glance. The burden of work on the cost office has been lightened considerably. Above all, the management gets a regular flow of accurate and up-to-date information on the progress of the business.

COMPLEX PROBLEMS

Because of the ubiquity of the firm's products, the manufacturing activity to which the new system has been applied is exceedingly complex. To meet demands from all branches of engineering, Hoffmann ball and roller bearings are made in nearly 25,000 different type sizes, with diameters varying from ¼ inch to six feet or more. About one-third of this range is 'alive' at any time; and as old designs die out they are constantly replaced by new ones.

The basic components of a bearing are an inner race, an outer race, a large cage and, of course, a set of balls or rollers. In fact, there are often many others. Altogether, Hoffmann produce about 30,000 different components, some of them for use in several types of bearing.

Batch quantities are matched to current and anticipated orders and may run into many thousands. At the other extreme special designs are frequently produced on a 'one off' basis.

Most of the manufacturing and assembly is done in four factories on the Chelmsford site. One of these factories concentrates on the production of cages; the others specialise in different sizes of bearing—small, medium and large. There is also a factory at Gloucester which produces a special range of bearings, using some of the components made at Chelmsford. This keeps its own day-to-day production records but provides information which has to be fed into the main system.

OLD SYSTEM

The old manual system of record-keeping was divided into three parts. First came the **shop-floor records**, primarily designed to keep track of the batches of components as they passed through the various stages of production. Each manufacturing department (responsible for one stage of production) kept its own, using a visible edge card index and a simple in-out-scrap-balance system.

A major disadvantage of this method of working was the unavoidable duplication. When a batch of components was booked-out by one department it was immediately booked-in by another—giving in effect, a single recording for the price of two.

Every fortnight, moreover, the information in the shop-floor records had to be laboriously transferred to **movement sheets.** These were sent to the cost office, where the batches of work-in-progress were valued, using standard cost data, for inclusion in the monthly accounts.

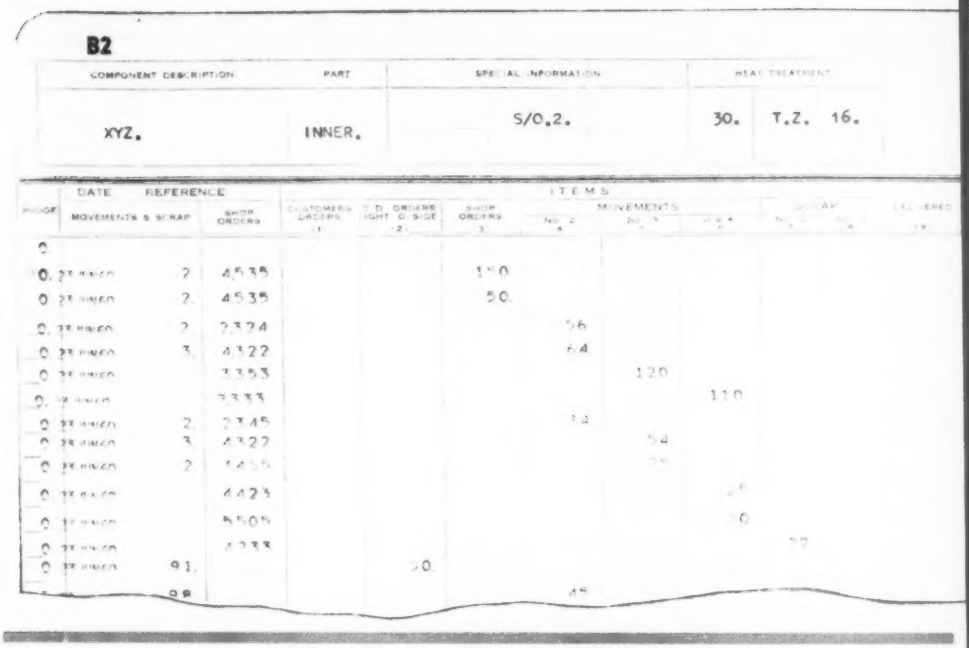
Neither the shop-floor records nor the movement sheets gave a full picture of the production situation and therefore they were of no use to the production controller when he issued new manufacturing orders. To fill this gap, it was necessary to maintain an entirely separate system of central **status records.**

The input for these was obtained from the original manufacturing order which was returned to the production control department after the work had been put through the first stages of manufacture. The exact 'number off' written on the order form by the shop foreman or his clerk was manually entered on a record card for the assembly in question. Thereafter the balance was adjusted by reference to:—

1. Scrap dockets, received daily from all manufacturing departments.
2. Periodical tabulations of orders despatched (a by-product of the punched card invoicing routine).

Unfortunately, the shop-floor records and the central status records were not compatible. The shop-floor records referred to components—a breakdown of the assemblies in the manufacturing

FACTORY COMPONENT STATUS RECORDS



B2

COMPONENT DESCRIPTION	PART	SPECIAL INFORMATION	HEAT TREATMENT
XYZ.	INNER.	S/O.2.	30. T.Z. 16.

PROOF	DATE	REFERENCE MOVEMENTS & SCRAP	SHOP ORDERS	ITEMS: CUSTOMERS ORDERS (1)	T.O. ORDERS RIGHT O. SIDE (2)	SHOP ORDERS (3)	MOVEMENTS NO. 2 (4)	NO. 3	NO. 4	SCRAP	DELIVERED
0											
0		2	4535			150					
0		2	4535			50.					
0		2	2324				56				
0		3	4322				64				
0			2353					120			
0			2333						110		
0		2	2345				14				
0		3	4322					54			
0		2	4455					56			
0			4423						25		
0			5505						10		
0			4233							12	
0		91.			50.						
		98					45				

order was obtained by pulling the appropriate 'component progress' cards from a master set and tabulating them on orthodox punched card equipment. The status records, on the other hand, referred only to assemblies. One complication was that, because certain components were used in several assemblies, it was often necessary to make 'transfers' after a batch of work had been put into production.

When investigating the possibilities of mechanisation, Hoffmann decided that the central status records could be made to do two jobs if they were applied to components. The other objective was that the production control department should be able to give the cost office work-in-progress figures already valued at the standard rates.

NEW PROCEDURES

The principle of the new central system is that every movement of work-in-progress is posted on the status record card for the component concerned. This card, measuring 22 inches wide by 12 inches deep, has two columns—'item' and 'balance'—for each phase of the production sequence, starting with the issue of shop orders and ending with despatches. The 'item' columns are on the left-hand side of the card and the 'balance' columns on the right-hand side.

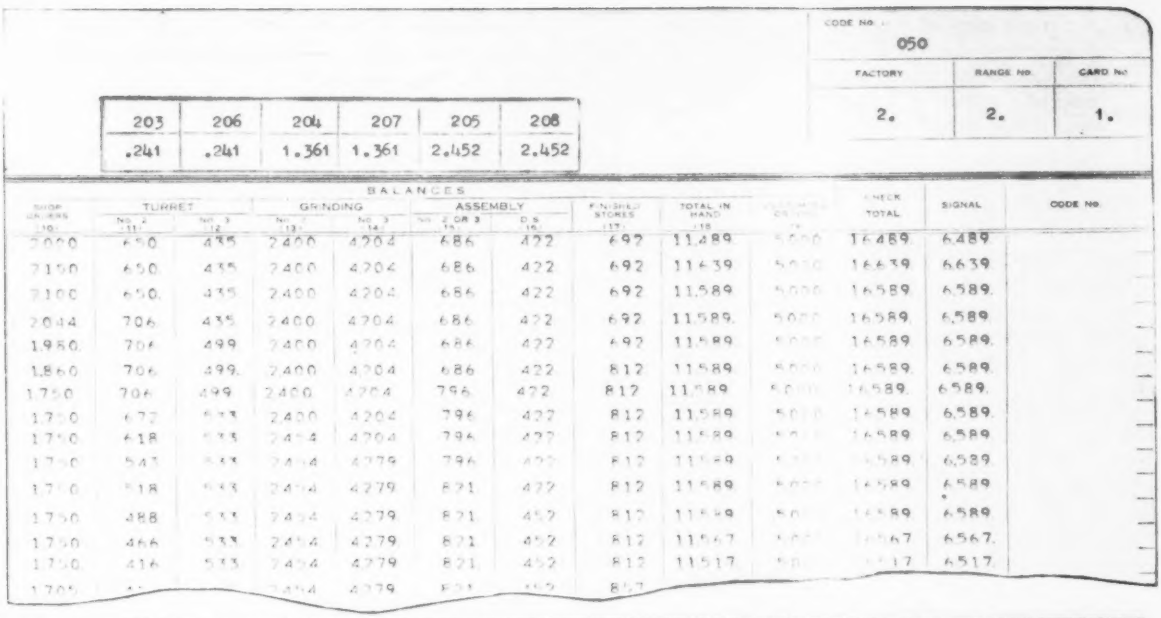
During the posting operation, the accounting machine automatically adjusts the balances affected by the movement. If, for example, a batch of 1,000 races has gone into the first machine section (turret lathe), the operator enters this figure in the appropriate 'item' column. The balance for 'shop orders' (representing a preliminary stage of manufacture) is promptly reduced by 1,000 and the 'Turret' balance is increased by the same amount.

Similar adjustments are made for movements from 'turret' to 'grinding', from 'grinding' to 'assembly', from 'assembly' to 'finished stores' and from 'finished stores' to 'delivered'. The balance is also reduced if scrap occurs at any stage of production.

In fact, the components may undergo more than one operation in the turret, grinding and assembly shops. The cards, however, have been designed to cover all possibilities without using an excessive number of balance columns. Because the manufacturing sequence depends, to some extent, on the type and size of bearing, there are also slight variations in the cards used for the different factories. These are distinguished by colour-coding in grey, pink, green or white.

A general description of the component appears in plain language and numerical code at the top of its status record card. There is also an 'egg box' panel in which are recorded the component's standard values (in respect of material and labour) at different stages of manufacture.

A 'check total' column on the right-hand side of the card, following the 'balance' columns, is used during a proof operation which ensures that all information has been picked up and entered correctly.



CODE NO.		
050		
FACTORY	RANGE NO.	CARD No.
2.	2.	1.

203	206	204	207	205	208
.241	.241	1.361	1.361	2.452	2.452

BALANCES											
SHOP (A. ASS. (10)	TURRET		GRINDING		ASSEMBLY		FINISHED STORES (17)	TOTAL IN HAND (18)	[illegible] (19)	CHECK TOTAL	SIGNAL	CODE NO.
	No. 2 (11)	No. 3 (12)	No. 2 (13)	No. 3 (14)	No. 2 OR 3 (15)	D.S. (16)						
2000	650	435	2400	4204	686	422	692	11489	5000	16489	6489	
2150	650	435	2400	4204	686	422	692	11639	5000	16639	6639	
2100	650	435	2400	4204	686	422	692	11589	5000	16589	6589	
2044	706	435	2400	4204	686	422	692	11589	5000	16589	6589	
1980	706	499	2400	4204	686	422	692	11589	5000	16589	6589	
1860	706	499	2400	4204	686	422	812	11589	5000	16589	6589	
1750	706	499	2400	4204	796	422	812	11589	5000	16589	6589	
1750	672	533	2400	4204	796	422	812	11589	5000	16589	6589	
1750	618	533	2454	4204	796	422	812	11589	5000	16589	6589	
1750	547	533	2454	4279	796	422	812	11589	5000	16589	6589	
1750	518	533	2454	4279	821	422	812	11589	5000	16589	6589	
1750	488	533	2454	4279	821	452	812	11589	5000	16589	6589	
1750	466	533	2454	4279	821	452	812	11567	5000	16567	6567	
1750	416	533	2454	4279	821	452	812	11517	5000	16517	6517	
1705	[illegible]	[illegible]	2454	4279	821	452	857	[illegible]	[illegible]	[illegible]	[illegible]	

EQUIPMENT

The status record cards—30,000 in all—are kept in a fleet of posting trolleys which can easily be moved from one work station to another. The posting itself is done on a battery of ten National Class 31 accounting machines.

Each machine has a series of electrical contacts which enable it to pass information to a National punched paper tape recorder. This unit is 'programmed' to pick up only the figures which are needed for the costing part of the system. It does its job automatically, without slowing down the conventional posting operation or calling for any attention from the machine operator.

The captured data could be punched straight into 80-column cards. However, Hoffmann's chose the tape system because of the compactness of the tape punch. Measuring only 13 inches wide by 11 inches deep by 11 inches high, it does not require any floor-space—an important point where a battery of accounting machines is used. After the postings have been done, the tapes produced by all ten machines are converted to cards on a single piece of equipment in the punched card section.

POSTING OPERATION

The machine posting operation involves the following steps:—

1. The operator enters on her keyboard the code numbers of the two departments affected by the 'from-to' movement of components. These are automatically punched into the paper tape. They are also printed on to tally roll to the right of the status record card (thus providing a visual check), but not on the card itself.
2. The operator then enters the 'in' and 'out' standard times for the movement, read from the panel at the top of the card. These too are punched into the tape and also recorded visually.
3. She picks up and enters the balances recorded on the card and also the 'check total' (representing the sum of the balances). The machine automatically edges the balances together and compares the result with the check total. If everything has been entered correctly, a '0' is printed in a 'proof' column at the extreme left of the status record card, telling the operator that it is in order to proceed with the posting.
4. Next she enters the number of the docket on which the movement is reposted. This is punched into tape.
5. The batch quantity is then entered. Controlled by stops on its program bar, the machine automatically adjusts the appropriate balances, while the tape punch 'captures' the key figures.
6. The machine subtracts total customers' orders from total work in hand, as recorded in columns on the right-hand side of the card. The result of this calculation is printed in a 'signal' column—in red ink if the orders exceed the work in hand.

7. A carbon copy of every posting is made on a summary sheet held in the back-feed of the accounting machine carriage and automatically advanced by one line whenever a new status record card is inserted.

POSTING MEDIA

Every manufacturing order includes a routing card, which accompanies the batch of components through all stages of production.

Whenever the batch moves from one stage to another, a single-item docket is raised by a booking station in the department which has just despatched the goods. Scrap is reported in the same way.

These dockets become the main posting media. The only times when information does not flow directly from factory to status records are at the beginning and end of the manufacturing cycle. Because the working documents then refer to whole assemblies, the accounting machine operators have to rely on the "component analysis" tabulations produced by the punched card section.

FLEXIBLE OPERATION

The machine posting operation is very largely controlled by an interchangeable program bar attached to the front part of the carriage. This has a series of "stops", pre-selected by the operator to suit the type of stock movement which she is recording.

The programming system is so flexible that it accommodates every type of stock movement in or between the four Chelmsford factories. In fact, the operator's manual of instructions lists no fewer than 78 possibilities.

For each movement, the following information is given:—

1. The movement—described in plain language.
2. The cost code number (to enable the operator to select the appropriate standard values from the panel at the top of the status record card).
3. The number of the stops to be used.
4. The number of the "item" column in which the batch quantity is to be entered.
5. What results to expect from this semi-automatic operation; ie, which of the balances on the card will be increased and which of them reduced. (This enables the operator to check the first of a batch of postings involving similar stock movements.)
6. The type of docket (identified by a code number) which reports this particular type of movement.

The procedure sounds complicated but is, in fact, straightforward. To avoid frequent changes in the setting of the machine, the dockets are batched so that similar movements are posted in succession. Moreover, when allocating work to an operator, the supervisor usually supplements the instructions in the manual by giving a simple verbal briefing on the lines of: "This is a move-

Hot[illegible] employ a battery of 10 accounting machines to update 30,000 records.
Now[illegible] girls in the section had previous experience of working accounting machines

ment from ——— to ——— You need to stop number ——'.

The accounting machine operators were recruited from the girls who had been handling the manually-compiled status records. None of them had any previous experience of machine accounting but after a short period of instruction on Hoffmann's own premises they quickly became proficient. At present, the team of ten operators are handling about 30,000 postings each week.

PROCESSING THE TAPES

The 'date capturing' part of the operation is automatic and unobtrusive, so that the accounting machine operator can virtually ignore it.

At the end of each day the tapes are sent to the punched card section and put through a machine which re-punches the 'captured' information into cards at the rate of about 600 cards per hour.

The cards are then processed on an ICT Programmed Controlled Computer, which calculates:—

the new work-in-progress values

and produces weekly tabulations for the cost office. (In this case the operating speed is over 7,000 cards per hour—or one every half-second.)

In a subsequent operation the standard costs are automatically compared with actual costs (extracted from other works records) to give the management a monthly statement of the 'variances' for each cost centre in the firm's budgetary control system.

The computer is not fully employed on the production of cost statistics. In addition to the 'component' tabulations mentioned previously, it does invoicing and sale statistics.

PRODUCTION PLANNING

The new work recording and cost analysis system is closely linked with the processing of customers' orders. In this way, Hoffmann make sure that their complex manufacturing schedules accurately reflect the current demands for their products.

The aim, of course, is to be able to offer a highly competitive delivery service without tying up capital in excessive stocks. So far as the more popular items are concerned, a broad manufacturing program is drawn up for six months at a time; but every month it is revised in the light of the current stocks/orders situation. The dimensions of this task can be gauged from the fact that the number of customers runs into many thousands and orders are despatched at the rate of about 1,000 per day.

FOLLOWING AN ORDER

When an order is received by the sales office, the information is transferred to a standard order slip. Price, discount and delivery instructions are also recorded. The slip is then sent to the production control department, where delivery promises are made with reference to other commitments.

After this, the slip goes to the punched card section. There the information is punched into 80-column cards—one for each item due for delivery in a particular month.

The cards punched in this way are combined with pre-punched cards detailing the components in each assembly. From this combination is produced a complete breakdown of the components required to meet the new batch of orders. It is this weekly tabulation which becomes the posting medium for the customers' orders column of the status records.

The cards are then 'interpreted' on a machine which reproduces in ordinary print the information already punched into them. Thus they become the actual working documents for production planning and progress control.

The production controller refers to them when drawing up his manufacturing schedules for the coming month. Afterwards they are filed, together with the corresponding order slips, in the production control department, providing a schedule of assemblies due for delivery in specific months.

When an item becomes due for delivery, the slip is extracted from the progress files and sent to the finished stores to authorise the despatch. It is returned to the production control department as soon as the despatch has been made. The corresponding punched card is then extracted from the files and sent to the punched card section for use in the weekly tabulation of deliveries against customers' orders.

ANNUAL TASK

At the end of the last financial year, details of all work-in-progress were picked up from the status record cards and simultaneously punched into paper tape. The tapes were then sent to a service bureau for processing on a computer. The results of this exercise were compared with the manual method used previously and as the results proved satisfactory and economical a similar system will be adopted for future years.

Under the old manual system, the preparation of opening balances was a massive clerical undertaking, which kept about 100 people busy for a complete week-end, with a lesser number of people performing the calculations over several weeks as opportunity occurred.

Hoffmann used a service bureau for this operation because at such an early stage of the new project they did not wish to interfere with the routines being put on to their own machines.

How to use — and misuse — consultants

- **Don't turn the whole job over to consultants**
- **Don't let them become line or operating executives**
- **Don't use them to write programs**

H W Matthews, *Urwick Diebold Ltd*

It is always a little embarrassing for a consultant to broach the question of how his services can be most effectively used, but there are really few people better placed to provide the answer. The proper answer is obviously important: misuse of a consultant's services can not only waste time and money, but can cause the ultimate result of a data processing project to fall far short of what is attainable. On the other hand, if qualified consultants are used judiciously and effectively they can make a major contribution to a company's automatic data processing activities for a relatively modest cost.

By examining the situations in which a consultant can contribute and by indicating the ways in which he should and should not be used, a picture emerges of the work data processing consultants can handle for companies. As an objective approach we shall start with the ways *not* to use consultants.

DON'T TURN THE WHOLE JOB OVER TO CONSULTANTS. It is wrong to expect a finished product—to say 'here is my present system. Come back in two years with a complete system that I can install.' There are many reasons for avoiding such an approach and stating it in such an extreme form helps to make the reasons obvious. Nevertheless, there have been cases of firms that have ordered a computer and then relied on a combination of consultant and manufacturer to get the system designed, installed and operating.

although the assignment may not have been expressed in such direct terms. More often the situation comes about through a gradual reduction in the number of company personnel available or through the inability or unwillingness to release staff as originally planned. Then reliance is placed more and more on parties outside the company, and the result is a system programmed and ready to operate and handed over to the company on a plate.

Such a system will probably work in the sense that the computer will operate, and the planned results will be produced after teething troubles. But there will be three things basically wrong with it:

1. It will not produce anything like the full benefits for the company. Simple applications such as payroll, or the straightforward conversion of punched card applications may occasionally be handled in such a manner. But it is virtually impossible for someone from outside to develop completely on their own, a sophisticated system for handling a firm's more complex data processing operations such as production control or material control *(as distinct from stores records)*.
2. The system will not meet the specific needs of the company. This will be self-evident. If a system is to be designed to meet the particular needs of a company, its management must help in deciding what is required of the system, and its staff must participate in its design. And it is unquestionably true that every company is unique.
3. There will be a distinct possibility that sooner or later the system will break down. Procedures and requirements change with time and the means must exist to reflect these changes in the automatic data processing system. This requires first of all qualified people who have been trained in the equipment and in programming. Secondly, the task of reviewing the changes and making the necessary revisions of the system are made easier if the people who do the work are familiar with the principles and procedures that were used in developing the original system.

Contrary to what might be thought initially, cost is not one of the reasons for avoiding such an approach. In the short run it may very well cost a company less to hand over the work to consultants and manufacturers than to bear the expenses involved in allocating staff, training them and their replacements and bearing the cost of the many false starts and mistakes that may be made. It is, in fact, the long-term factors that make complete or excessive reliance on people from outside an unwise policy.

DON'T LET CONSULTANTS BECOME LINE OR OPERATING EXECUTIVES. This danger does not usually arise in the preliminary stages. In the feasibility study and preparation stages it is acceptable—even advisable—to have a participating consultant guide the study team, but it should be known that he is acting as a representative of, or an adviser to, a company executive.

In the later stages of installation and operation of the system there can be a tendency to confuse the consultant with an operations manager, to the extent that day to day operating decisions are expected from the consultant. By this time a qualified computer team should exist to handle the routine matters of daily computer operations, the consultant being available for advice and counsel on non-routine matters.

DON'T MAKE A POLICY OF USING CONSULTANTS TO WRITE COMPUTER PROGRAMS. The occasional use of consulting services to do detailed programming for special problems or to ease peak loads is often good policy, but in general it is both unsound and expensive to use consultants for this type of work.

Needless to say, there are also right ways of using consultants for automatic data processing projects. And whereas the 'don'ts' can be applied equally well to consulting in general, the 'do's' are more closely related to the particular characteristics of an ADP project. Here are some of the profitable ways to use consultants.

CONSULTANTS CAN BE EFFECTIVELY USED FOR FEASIBILITY OR JUSTIFICATION STUDIES. They help to ensure that the conclusions are accurate and objective; they help to get the study completed in a relatively short period of time, and their participation is an excellent means of training company personnel.

In those projects where there is a reasonable chance that some form of automatic data processing can be justified, staff should be allocated to work with the consultants from the beginning. However, in some projects there may be a doubt as to whether a major feasibility study would be warranted. In such cases it can be useful for qualified consultants to make a brief independent survey to determine whether a major study is warranted or not.

In many cases the short study will provide more than the 'yes' or 'no' answer as to whether a detailed study is likely to show that automatic

data processing will be justified. It can also indicate the specific obstacles that must be overcome or the changes that must be made. For instance, a short study made recently for an insurance company operating with two fairly autonomous divisions, indicated that economically a computer would probably be justified, but only if it was used jointly by both divisions. This would require certain organisation changes without which it would be useless to proceed. The company was thus able to see that the first question to tackle was that of determining the extent to which it was prepared to make the necessary changes.

In manufacturing companies, similar brief studies have revealed the assumptions on which justification would have to be based, or the extent and nature of the basic systems work that would be necessary as a preliminary to any ADP system. The companies would thus in a position to assess the validity of the assumptions (such as, for example, the value of intangible benefits) or to carry out the systems improvements before committing themselves to the cost of a major feasibility study.

FOR COMPANIES THAT HAVE ALREADY MADE THEIR OWN COMPUTER PLANS A REVIEW BY EXPERIENCED CONSULTANTS IS VALUABLE. Such a review provides more than an objective opinion of the situation or of a decision that is often made with much feeling as fact. It can also indicate possibilities that have not been realised and it can assess the validity of the assumptions on which the project is based.

The assumptions are of various kinds and most ADP projects are based on one or more of these. Assumptions are made firstly on the capabilities of computers. They include not only the speeds at which the system will actually be able to do the work (in contrast to the theoretical speeds), but also the time that will be available for productive work. These assumptions are a significant factor in a case for automatic data processing. They affect the economic case and influence the amount of peripheral equipment required.

Secondly, assumptions are made on the operation of the system. An ADP system is obviously dependent on much more than equipment. It is geared to the whole system of data preparation, reporting and data availability. Many systems are designed to process data that are not sufficiently accurate for acceptance by the computer, whilst others have no adequate provision for collecting and preparing the data so that they will be available at the right time. Any system is also dependent on assumptions about the use of output, often based on what is thought to exist rather than what actually does exist. One computer system produced a complete set of stock reports for a group of people who really already had the information before it reached the computer, and they were not interested in having a more refined version covering the whole company rather than their own particular section.

These apparently obvious situations sometimes become confused during the course of the long meetings and discussions that occur in a computer project.

There are also, of course, assumptions that are made about costs and savings. Some of these are concrete matters that can be estimated with a reasonable degree of accuracy such as the number of people that will be replaced and the number required to operate the new system. This is the area in which it is easiest to assess carefully the basis for the computer decision, whether it be positive or negative. The consultant's review may well show that expected costs can be reduced. For instance, by changing the proposed computer procedures, and by reconstructing the files, it has been possible to do a given job with equipment of a smaller scale, thus converting a marginal case to a good one.

In considering costs, adequate attention has to be paid to what is involved in designing the system and making the conversion, and it is in this area that haziness often prevails.

Next, there are the assumptions that are made about intangible benefits. If these assumptions are being used to justify the system, it is particularly advisable that they are analysed carefully to determine whether there is a real chance of obtaining them, and whether they have been properly valued. Information on inventory levels will not automatically reduce inventory, nor is there anything automatic about the savings or profits that can come from providing sales and production information earlier. In all these cases there must be a way in which the new or earlier information is going to be so used that there is potential for saving. In considering intangible benefits the approach of some companies is to plan to break even on the basis of clerical cost reduction, and then have time to do additional work. Because the benefits arising from the additional work are 'free' there is no need for detailed justification. If such an approach has been followed it must be ascertained that the equipment selected will eventually be able to do the work that is required to produce the intangible benefits, and that those benefits are really worth having.

Finally, there are assumptions as to how the work is to be done. In an automatic data pro-

cessing system, as in any manual system, there are expensive ways and there are economical ways of operating. There are ways that require a great deal of computer time or a large system, and there are sometimes ways of obtaining similar results through a less expensive approach.

To summarise, a review by qualified consultants can provide a final answer as to whether to proceed or not, and, if so, how to go ahead in the best manner.

CONSULTANTS ARE VALUABLE IN GIVING GUIDANCE DURING THE THREE STAGES OF PREPARATION, CONVERSION AND IMPLEMENTATION. They can offer helpful suggestions, anticipate and point out errors and make sure that the progress of the work is such that the system will be ready to operate on schedule. They can work with the company in planning the conversion, in training staff and management, and in providing the initial impetus that is so often necessary to get the project moving—to get decision turned into action. Their ability to insist on the need for adequate resources of staff and time can often prevent those difficulties that occur when the program is left completely in the hands of internal staff who, being subordinate to the operating departments, are unable to insist on having sufficient staff of the right kind. In these cases the consultant can obviously only insist by pointing out the real needs, but at least he cannot be silenced, nor can he be accused of empire building.

One of the more important functions in this period is to educate management on the needs and the potential of automatic data processing. An effective orientation can assist in developing a constructive and helpful attitude on the part of management not directly concerned with the ADP program, and thereby do much to assure the success of the project.

CONSULTANTS CAN HELP IMPROVE EXISTING INSTALLATIONS. A computer centre and the systems and programming work associated with it represents a costly centre of operations and one which is generally quite new. The system can be operated efficiently or inefficiently, and the way in which the centre is run can have effects not only on its costs of operation, but also on the results it produces. The application of sound and tested methods and procedures can do much to improve the output from the computer, and from the systems and programming groups.

Reviews of existing installations are not only effective in reducing costs, but they can also extend to a study of the applications being handled, the results being produced and the accuracy and appropriateness of the data that the system develops.

The use of consultants for such work is particularly valuable when there are organisational questions involved, and when those questions affect the way in which the system works or the effectiveness of the computer results.

CONSULTANTS CAN BE EFFECTIVE IN RESOLVING SPECIFIC QUESTIONS OR DISAGREEMENTS. There are often major differences of opinion such as whether a centralised or decentralised system should be installed, whether technical and scientific computing should be separated from or combined with data processing, and where the computer activity should be placed in the overall organisation. The resolving of such differences is an obvious use of consultants. They are objective and impartial and they are not handicapped by company tradition or departmental bias. Perhaps, even more important, they bring to each problem their experience of handling similar problems on other occasions.

The Scope of 'PLANNING AND PRACTICE'

This series of articles on the fundamentals of ADP has been designed to provide a practical guide for those concerned with reviewing and revising data processing procedures and introducing universal business machines. Previous articles have dealt with deciding whether a feasibility study was worthwhile, organising for such a study, and what a feasibility study should be, as well as how to shop for a computer and how to cost and justify an automatic system.

Future articles in this series will include: How to use a computer service bureau—The organisational implications of ADP—How to operate a computer centre—The vital phase between an order for a system and its installation.

Taken together the articles in this series should provide a practical and complete guide to most problems that confront management on the brink of business automation.

Back numbers of AUTOMATIC DATA PROCESSING are available on request to new subscribers who wish to see earlier articles in the series. [Price: 3/6 per issue.]

Robots' NOTEBOOK

Shares indices calculated at computer launderette

RECENTLY *The Times* initiated a new series of industrial share indices which are published daily. These indices are now calculated daily on a service basis at one of the London computer 'launderettes.'

The prime aim in using a computer centre for these calculations is, of course, speed—clearly an important consideration for a daily newspaper.

Eight separate indices are computed daily. The principal share index consists of 150 industrial ordinary shares. This is subdivided into two sections—one reflecting changes in 50 leading companies with a market valuation of over £30 million, and the other reflecting changes in the remaining smaller companies.

There are also indices for companies producing capital goods, consumer goods and primary commodities; for gold mining shares; and for industrial preference charges.)

To produce the indices, the current price of each share in each index is calculated as a percentage of its price on the base date of 2 June 1959. The index number is the arithmetical average of these percentages, weighted according to the market value of the stock on specific dates before and after the base date.

The purpose of weighting is to take in account the size of each company. For example, if the stock of a company with an average market capitalisation of £200 million goes up one percent, the effect on the index will be ten times as great as if the same increase had occurred in the stock of a company with an average market capitalisation of only £20 million.

The formula by which the index numbers are computed is modified when any price is affected by financial reorganisation in the company concerned (particularly if it concerns either a scrips or rights issue).

These calculations are fairly simple—as a computer job. Yet, in view of the urgency with which the results are needed, they would present problems if only slides and desk calculators were used.

By using a computer centre (National's centre in Marylebone Road) the city office of *The Times* receives a printed set of indices in ample time for comment to be made on indices movements before going to press.

The service is organised in this way: after 5pm. each day, the closing prices for some 245 stocks and shares included in the index numbers are telephoned from the paper's city office to the computer centre, where they are written down by the operators responsible for punching the information into paper tape: each price is 'called back' as a check against telephone errors.

Later the paper's city office also dispatch a written copy of the prices, and this copy is compared with the telephoned prices.

The prices, coded on to punched tape, are fed into the computer which does the calculations automatically—the same program is used every day—and punches the results out, again on to paper tape, which is then used in a teleprinter to obtain the results 'in clear.' The new set of indices is telephoned to *The Times* and the printed copy is dispatched by the original messenger.

The machine operation is accomplished very quickly once the program has been stored in the computer and the input punched tape prepared.

If the price of any share is affected by a scrip or rights issue, details of this are punched and read into the machine, which automatically modifies the base price on which the corresponding index figure is computered.

The computer program applies one special check. At the start of each daily run, the previous days figures are fed in. As the current figures also go in, they are compared with the previous day's prices, and if any price is changed by more than five percent up or down, then the details are printed out in the form of an exception report. This insures against punching errors and failure to take into account new issues affecting the closing prices.

Carpet manufacture controlled on charts

FORWARD loom loading at the Kidderminster factory of the Carpet Manufacturing Co Ltd is now plotted on a series of wall charts in their production department. Charting procedures have enabled production changes to be accomplished more smoothly.

Three charts are used in the production department: and there are two further charts in the works which duplicate some of the information shown on the other three boards. The charts in the pro-

duction department cover a production cycle of ten weeks; those in the works cover a period of six weeks.

A date scale runs across the top of the panels. Title frames running down the left-hand side of each chart indicate looms. A flowline (a length of elasticated cord) is extended horizontally from each title frame to show the total load on the loom represented. Pegs inserted at various points along the flowline show when each pattern must be put on the loom, and when the pattern is due to be completed. Small title frames inserted between the pegs give the pattern number and yardage required. Further coloured pegs, under the title frames, indicate the progress of the materials needed for the pattern—for example, whether dyed prepared or set up.

By using these charts, any changes in production plans can be dealt with quickly. Also, any materials which are not ready a week before a pattern is due to be put on a loom can be 'chased.'

The charts (known as Movigraph Rotadate charts) consist of perforated plastics panels, into which signals of various shapes, sizes and colours are inserted.

The loom loading situation can be plotted over an indefinite period as the panels are interchangeable: when a panel covering an earlier period becomes out of date, it is removed, the remaining panels are slid along, and a fresh panel is inserted.

Bank automation in Hong Kong

FROM Hong Kong comes an example of the way in which ADP is changing long established commercial practices.

For almost a century the Hongkong and Shanghai Banking Corporation has employed only men. This tradition has now been broken by the installation of Post-Tronic account posting machines, which do so many things automatically that they can be operated by girls with no experience.

Since male bank clerks are at a premium in Hong Kong, the new machines have solved a major staff problem.

The bank is using its 16 Post-Tronics to keep track of about 20,000 accounts. Previously this work was done on 40 book-keeping machines.

Founded in the days of quill pens and parchment ledgers the Hongkong and Shanghai Bank is planning other developments in automation. One possibility is that its cheques will be put through a cheque sorter which will simultaneously punch information read from them into paper tape. If this system is adopted, the punched tapes will be used to operate the battery of account posting machines, thus dispensing with operators.

COURSES AND CONFERENCES

15 August-2 September
Course on the Emidec 2400 computer
Organised by EMI Electronics Ltd
Fee: 50 guineas
Venue: Hayes, Middx.

22 August-23 September
Programming Course on Leo II
Organised by Leo Computers Ltd
Fee: 110 guineas
Venue: Hartree House, 151a-159a Queensway London, W2

29 August-2 September
Programming course on the 802 and 803 computer (principally for members of Universities and Technical Colleges)
Organised by National-Elliott
Venue: Elliott Brothers Ltd, Computing Division, Elstree Way, Borehamwood, Herts

5-9 September
Second International Conference on Operational Research at Aix-en-Provence
Organised by International Federation of Operational Research Societies
Venue: Aix-en-Provence
Enquiries to: Miss G M Heselton, B.Sc, Secretary, Operational Research Society, 6 Cannon Street, London, EC4

5-9 September
Programming Course for Deuce
Organised by Glasgow University, Computing Laboratory
Venue: Glasgow University
Enquiries to: The Secretary, Computing Laboratory, The University, Glasgow, W2

5-23 September
Course on the Emidec 1100 computer
Organised by EMI Electronics Ltd
Fee: 50 guineas
Venue: Hayes, Middx

12-28 September
Programming (SIAC) System for Deuce
Organised by Glasgow University
Venue: Computing Laboratory, Glasgow University
Enquiries to: The Secretary, Computing Laboratory, The University, Glasgow, W2

14-23 September
Programming Course for Ferranti Pegasus
Organised by The University of Southampton
Venue: Southampton University
Fee: £5.5.0 (residence £11.11.0)
Enquiries to: The Director, Computation Laboratory, The University, Southampton

'AMERICAN REPORT' our monthly feature from John Diebold and Associates, New York, will be continued next month

New High-speed Printer

One of the new generation of output printers that manufacturers have been developing to solve the computer output problem

A NEW high-speed printer has recently been introduced in Britain by National Cash. It is a versatile machine which can be directly coupled to a computer or used for off-line printing. Already National Cash have delivered the first model of this printer to Crosse & Blackwell Ltd, the canned food producers.

Crosse & Blackwell presently use it to reproduce information which their National-Elliott 405 has previously recorded on magnetic film and in fact produce invoices on it, though the printer may be used in future instances to take off information which has been recorded on magnetic tape.

Normally the printer consists of three inter-coupled units. The first contains the printing and paper-feed mechanisms; the second contains a set of thyratron valves which 'trigger off' the printing mechanism; and the third is a buffer which reads the magnetic film and sends instructions to the thyratrons.

The paper feed accommodates a single web of paper, on which a four-part set of forms (original plus three copies) can be printed. After printing, the paper is neatly folded in a carrier in front of the machine.

Normal operating speed is over 600 lines of alpha-numeric information per minute. For models now being installed by American firms the speed is in fact as high as 850 lines a minute and even higher where only numerals are printed.

How it works

Ever since the introduction of business computers, manufacturers have been putting tremendous effort into the development of fast printing devices.

The main difficulty has been in designing a method of printing which is robust enough to stand up to periods of sustained working. As in other branches of automatic data processing, it is often found that the 'electronics' of a system are inherently more reliable than the mechanical parts which have to keep up with them, especially those parts which move intermittently.

In the National system, most of the onus for providing clear, accurate print is borne by electronic devices. There are no intermittently-moving typebars or styli; the typeface is mounted on a series of 120 wheels which rotate continuously at high speed.

Each wheel carries the full range of 56 letters, numerals and symbols, and represents one printing position in the line. Beneath it is a small hammer which knocks the stationary paper against the wheel at the precise moment when the selected character is passing. There are 120 of these hammers, one for each type wheel, and each has its own firing mechanism. The wheels are keyed to a common shaft so that, in effect, they form a cylinder carrying horizontal rows of identical characters.

The continuous web of paper, drawn from a basket at the back of the machine, passes between the wheels and the hammers and is momentarily halted while each line of type is printed. As in the case of an ordinary typewriter, the impression is made through an ink ribbon which moves only while the machine is actually printing.

The hammers which force the paper against the typeface are fired by capacitors and electro-magnets. These, in turn, are controlled by the thyratron valves. Each type wheel is associated with one particular hammer, electro-magnet, capacitor and thyratron.

Before each line is printed, 80 characters are read from the magnetic valve and stored in the memory of the buffer unit. There they are scanned repeatedly as each of the 56 rows of identical characters on the type wheels passes above the printing line. When, for example, the row of A's is passing, the buffer picks out every A in its memory and instructs the thyratrons to fire the hammers corresponding to the positions in which this letter should be printed. The same

operation is repeated, a fraction of a second later, for the B's and then for the other characters or symbols.

Generally there is no need to repeat the scanning operation for all of the 56 type-wheel positions. Printing ceases just as soon as every character stored in the memory has been printed. The machine then sets up the information for the next line, while the web of paper is advanced automatically. It is this feature which enables the user of the National printer to obtain speeds exceeding the nominal rate of 600 lines per minute, especially when printing is restricted to the ten numerals.

The capacity of the buffer's memory is 80 characters. This is more than enough for most business printing, where it is seldom necessary to print 'solid matter' across the full width of the paper. However, lines containing between 80 and 120 characters can be printed quite easily by dividing the information into two parts and automatically suppressing the paper shift after the first part has been printed.

Controlling the paper

The printer handles continuous forms up to 22 inches wide (12 inches printing width). For registering and advancing the web of paper, it has two sprocket wheels which can be moved along their common driving shaft to accommodate forms of different widths. The teeth of these sprocket wheels engage a row of perforations in each side of the paper.

The shaft is driven through an electro-magnetic clutch which also incorporates a device for slowing down the paper when required printing position is reached. To make sure that each line is correctly positioned, there is an electronic control, consisting of a slotted disc and a photo-electric cell, on one end of the shaft.

Another electronic unit governs the vertical format of the printing. This uses a loop of plastic tape, the length of which is exactly the same as the depth of the form to be printed. By reading instructions punched into the tape, the control unit progressively moves the paper into pre-determined printing position. It also checks the registration after these movements have been carried out.

During the printing operation, the loop of tape moves in synchronisation with the paper. Because its length corresponds to the depth of the form, this arrangement ensures complete accuracy when the information is reproduced, as is usually the case, on pre-printed stationery.

The instructions punched into the loop of tape are read continuously throughout the printing operation, and the loop is quickly replaced when it is necessary to change the vertical format. Loops for different formats are prepared with a special punch and can be used over and over again.

When the format is controlled in this way, the paper advances at the rate of 4,000 lines per minute. For continuous line-by-line printing, the shift takes place in less than 20 milliseconds on single spacing and less than 30 milliseconds on double spacing.

The horizontal format of the lines is controlled in a different way, although the method of control is equally flexible.

Foolproof working

There would be little purpose in developing a printer which did more work than conventional machines but, in doing so, made a correspondingly larger number of errors. To guard against this a variety of checking devices have been built into the printer to ensure that the contents of the magnetic film are faithfully reproduced and also to warn the operator if anything needs attention.

In the first category, there are such things as a parity check on each word recorded on the film; and also an echo check which verifies, at each instant of the printing cycle, that the correct thyratrons have been fired and therefore the correct characters have been printed.

The state of the machine itself is indicated by one of four coloured lights:

Warm up (blue) indicates that although the machine has been switched on, it is not yet ready to print.

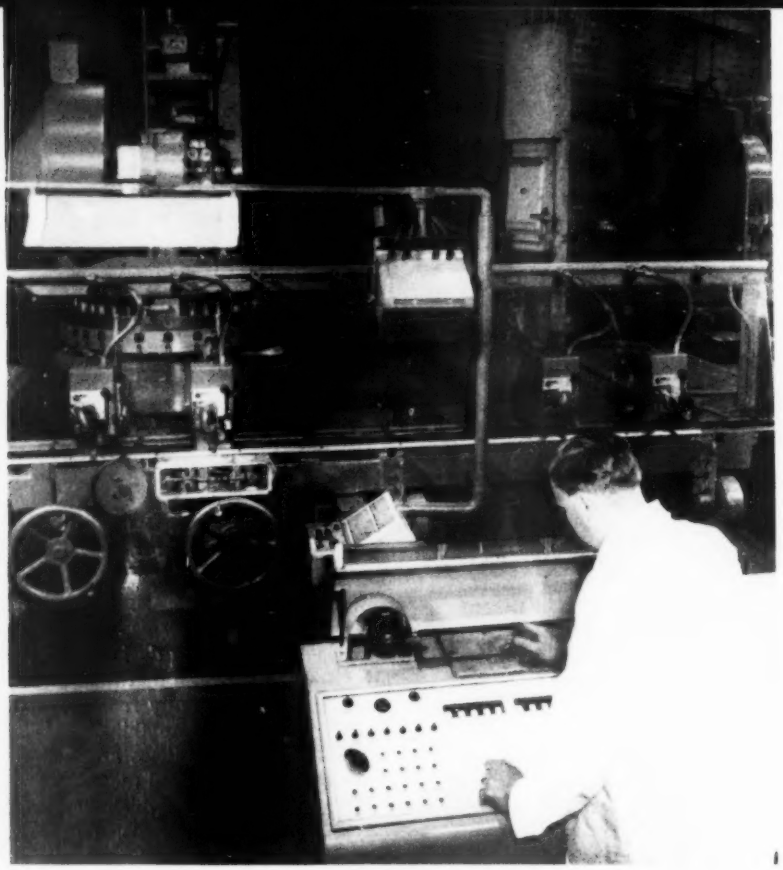
Operating (white) appears when the buffer is passing signals to the printer, provided that there are no errors in the printing mechanism, the thyratron cabinets, or the buffer itself. The light is extinguished if a fault occurs in any part of the system.

Error halt (red) gives warning of one or more of the following faults:

—The electronic switch has failed
—There is no paper
—The paper has broken
—There is no carbon ribbon
—The ribbon is not feeding properly
—There is no vertical format control tape in position
—The vertical format control tape has broken.

In all such cases the printer stops automatically until the fault is rectified.

Paper Halt (blue) appears as soon as the last line in the last form has reached the printing position. If it is accompanied by the red 'error halt' light, this indicates that there is no paper in the printing position.



Used by GEC to produce switchgear cubicles, this Wiedemann turret press has been adapted for automatic control

Panels punched by tape

A machine control system developed by GEC is automatic, gets 25 percent more work from a press and eliminates the mental fatigue previously encountered

from a Special Correspondent

AN automatic control system using teleprinter punched tapes to initiate electrical impulses which are translated into machine movements by means of telephone relays has been applied to a Wiedemann turret press at the Witton (Birmingham) works of the General Electric Company.

Wiedemann turret presses are employed at the works to punch out the sheet steel panels used in the manufacture of indoor switchgear cubicles. A typical press is shown opposite. These panels are punched with a series of standardised apertures corresponding to the instruments, relays and accessories fitted to the switchgear cubicles. For many years presses of this class have been operated manually, and the decision to develop an automatic system of control was influenced by the fact that the operators tired rapidly from the strain of continually watching the scales which indicate the position of the panel relative to the punch.

The task of devising an automatic control system was assigned to the control engineering group of GEC's research laboratories at Wembley, and in conjunction with engineers at the Witton works, an efficient and reliable control system was evolved which was put into commission last year.

The Manual System

The Wiedemann press used to punch the panels has a capacity of 71 tons and is fitted with a turret containing 32 punch and die sets of various shapes, together with an air-operated centre punch, making a total of 33 stations. Any of these stations can be positioned under the press ram by rotating the turret. The top portion of the turret carries the punches and the lower portion the dies; each is driven by separate chains from a common shaft and is locked in position by a sliding pin registering with the frame of the press.

The machine table is capable of carrying a plate of maximum size 10 feet, by 5 feet by ¼ inch between the upper and lower portions of the turret. The table is provided with two movements, one of which moves parallel to the machine axis ('Y' direction) and carries the other which moves at 90 degrees to the Y direction and is labelled 'X' direction. The plate is attached to the X direction slide by four clamps, any one of which can be retracted when it approaches the turret, thus allowing the full area of the plate to pass through the turret.

The slides are positioned by two handwheels to which are attached measuring scales marked in increments of one-sixteenth of an inch which cover the full movement of the slides; vernier scales enable the required dimensions to be set to one-sixty-fourth inch. The operator stands on a platform which is attached to the Y direction slide and hence moves in and out with the component. The handwheels and the push-buttons for actuating the ram and the turret are positioned so that they can be operated from this platform.

The operator is supplied with a chart showing the station number and the X and Y co-ordinates for each punch stroke. This chart is compiled by the programmer who converts the component drawing into this form.

Automatic Control

For the automatic scheme, punched paper tape (standard 5-hole teleprinter tape) was chosen for programming the instructions to the press, and it was decided to employ digital control throughout, using the well-tried PO type 3,000 relay, together with a number of rotary switches. Two small dc motors were fitted to drive each table movement, giving 3-speed control, and the induction motor driving the turret was replaced by a 2-speed dc motor.

Decoded by relays

When the press is under automatic control, a tape, carrying the information for punching a complete plate, is run through the tape reader. The perforations are read in discreet phrases and each of these is decoded by a set of relays which check the reading and route the information to the appropriate set of rotary switches. There are three sets of rotary switches, one for the turret and one for each of the table movements; their function is to store the next required movement. When the previous punch stroke has been completed, the three movements take place simultaneously under the control of the rotary switch sets and the associated motor control relays. The digital turret and table positions are fed into the rotary switch sets continuously from digitizers whose function is to convert the positions to an electrical code to an accuracy of plus or minus 0.01 inch. As the desired position is approached, the motor speeds are reduced, and when the position signalled by the digitizer coincides with the desired position, the corresponding drive is switched off and a brake applied. When all three movements have finished, a signal actuates the punch. Adequate interlocks and circuits are provided to minimise faulty operation of the system.

The tapes are produced on a Creed teleprinter which gives a red visual typewritten record with the punched tape as the by-product. When sub-routines are added or alterations are made to the master tape a Creed transmitter is utilised, the output of which is passed to the teleprinter, which then gives a black-printed record. By this means information added from the teleprinter keyboard is distinguishable from that added by the transmitter, and a changeover from one to the other is very easily carried out.

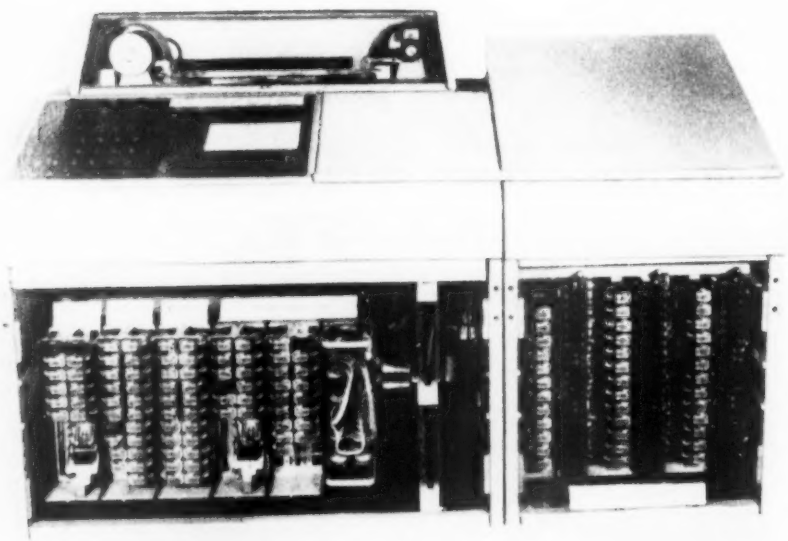
The information required on the tape for setting the machine and actuating the punch ram consists of a turret movement code followed by two decimal digit codes, a Y movement code followed by four decimal digits, an X movement code followed by five decimal digits, and the punch code. Each of these codes occupies one line across the tape and is made up of a combination of up to five holes. These combinations are grouped for easy recognition: a four-hole combination denotes a movement code, two holes denote a digit code, whilst a combination of an odd number of holes denotes a subsidiary operation such as an operator's instruction. These odd-number combinations are preceded by the letter code. This grouping provides a means of checking the movements and their limits while the tape is being read. The letter code cancels out the checking circuit when an odd-number combination is read. One whole setting occupies 13 inches of tape, but should a movement not exceed to be altered, it is not punched into the tape, a second feature that only the minimum amount of tape is employed.

The panels produced on the press are provided with a standard series of apertures, but the position of these apertures may vary from panel to panel. Time can be saved by programming the punches required to make each aperture, taking the aperture's centre point as the datum, and then adding these individual programs or sub-routines into a master program. When sub-routines are added to the master program in this way they are preceded by subsidiary X and Y co-ordinates which are accepted by the control, and the X or Y co-ordinates which follow are added or subtracted to give the true position. When the aperture has been punched, zero subsidiary co-ordinates are inserted so that any subsequent reading is as programmed. This method can also be used to make small identical components from a single large sheet of metal.

The control system is not able to carry out all the duties formerly performed by the operator, such as removing scrap and moving the clamps along the table. The program must, therefore, contain coded information to warn the operator that these tasks must be carried out. When this occurs the press is stopped automatically and the appropriate indication is given on the control panel.

Under automatic control higher output has been achieved by reducing operational time and by minimising physical fatigue and time lost when an operator is away from his machine. This has resulted in a *direct* operational saving of 25 percent in machine time, and a corresponding overall saving of 33⅓ percent as the operator is able to perform other work while the machine is in operation. Also the use of sub-routines by the programmer responsible for compiling the instructions has resulted in a saving in time (70 percent) and has greatly reduced the mental fatigue encountered in performing this operation.

A further important advantage resulting from the introduction of automatic control is a reduction in labour turnover. Under manual conditions operators are known to suffer from severe headaches due to the degree of concentration required and to the level of background noise. In consequence, requests for transfers to other machines are common and output varies considerably with different operators. With automatic control full output can be achieved, without physical strain, by an unskilled operator after a training period of two or three days.



Cornerstone of a system: the control desk opened to show the arrangement of relays which has meant increased output from the press

Whitehall's charity to the farmer runs into £50 million a year, chalks up some one and a quarter million payments and puts two computers through their paces

Grants to Farmers by Computer

P M J Williamson, *Computer Consultants Ltd*

GIVING grants to farmers to buy fertilisers, running a fatstock guaranteed price scheme, making various agricultural censuses—and working out the wages owed to the Ministry's employees—all these activities suggest a fair sample of the work one would expect the Ministry of Agriculture, Fisheries and Food to perform. Recently these specific activities have been mechanised, and it is possibly pertinent to point out that the work of a government department, contrary to what might be thought, is often comparable to the clerical work done in commercial organisations.

For example, the procedures carried out in running the fatstock scheme might just as well relate to nuts and bolts as to pigs and cattle, while some of the costing procedures become as complex as those encountered in engineering applications.

The fatstock price guarantee scheme was introduced by the Government in 1954 and only six months was available in which to set up an organisation competent to make one and a quarter million payments a year and distribute a total of £50 million.

The scale of the problem suggested at once the use of a computer, but the commercial computer was then in its infancy and it was natural that the scheme should be brought to life by making use of conventional punched card machinery. Even if a suitable computer had been available, the time limit would have precluded it. It was an achievement to do the system planning ready for the card equipment in the time available. The system was planned, however, with the thought in mind that a computer might eventually be employed.

In April and June of 1958 two Hollerith (now ICT) 1201 computers were brought into operation. They replaced some punched card machinery, but some equipment was retained, so that the installation remains a mixed one.

The punched card machinery and the computers came from the same stable, and staff with previous experience of the work collaborated with the Ministry's people in planning the conversion. Protagonists will continue to argue whether greater benefits accrue from such continuity or from a new and unbiased approach that someone unfamiliar with the punched card systems might contribute. What is agreed, however, was the value of having responsible staff on the Ministry side who were thoroughly familiar with the scheme.

Given the conditions prevailing in 1957, the Ministry decided not to wait for the ideal machine to arrive, nor to contract to buy an unproven design. With the machines available and their cost it was not thought feasible to do all the work of the department on computers. The installation is, therefore, a mixed one consisting of two 1201 computers, three 542 multipliers and one 555 calculator. When the 555 is fully operational, one of the 542 multipliers will be surrendered. Three 902 tabulators are used for off-line printing and approximately 50 punches and verifiers. There are other tabulators, collators, etc, for other work.

Improvements in the installation are still being made, one of the most important of which is the introduction of the 555 calculator. A procedure has been devised for calculating payroll on the computer, a job which is normally done by the 555 calculator, but apart from the fact that computer time is almost fully utilised already, the economies would be only marginal.

In deciding how the work was to be allocated

between the two computers and the other machinery the factors to be taken into account were the comparative cost of using alternative methods of processing and the necessity of ensuring that the tightest time schedules were met.

All transactions concerning liveweight cattle, sheep and pigs, whether sold by auction or private contract, and those involving deadweight pigs are dealt with by computer. Statistical analyses of work done on the computer, transactions concerning deadweight cattle and sheep, wages calculations, and a few exceptions from the computer work, like single lines entries for fertilisers, are processed on the 555 calculator and conventional punched card machines. A recent analysis has shown that the computer procedure for liveweight and deadweight pigs and fertilisers certified for subsidy has saved £20,000 per annum over the previous method with both computers fully loaded.

Grants for Fertiliser Purchases

The grant for fertilisers is paid on the basis of the chemical content of the particular fertiliser purchased. Payment may be made directly to the farmer or to the supplier on his behalf. The form of application shows the farmer's name and address, also the name of the fertiliser and its chemical analysis. All applications are sent in by the suppliers only. Each batch received from the supplier is kept together and a slip attached bearing the number of sheets in the batch. The batches are sorted by counties (statistics are compiled by counties) in the weeks when fertiliser sales are at their peak, some economies are to be achieved by processing a sufficiently large batch from a county as soon as it is collected. If, when the forms are being sorted, it is noted that a large number have only a single line of entry concerning a fertiliser, which is not a complicated compound, batches of 1,000 are extracted and processed by the 555 calculator with a special program designed for this purpose. As this can amount to as much as one-third of the applications at the peak period, the computer is successfully relieved of the less exacting calculations. The seasonal nature of the fertiliser work adds to the difficulty of designing an efficient system. The spring peak goes from a weekly figure of 7,000 to 40,000 in a few weeks and then drops again to 10,000 by September.

Batches are processed for payment to specific suppliers and payment is made as soon as work on a particular batch is completed. No attempt is made to settle accounts on a periodic basis.

After sorting and scrutiny, the data is punched into cards.

One of the conditions of the proficiency bonus paid to punching and verifying operators is that they must not exceed a 1.5 percent error rate. In fact the post-verification error rate is .015 percent.

The first operation on the computer after the data has been read from the cards is to check the listed ingredients from the application form against its known composition. The amount payable is then computed for each certificate according to the quantity of each of the constituent chemicals included in the scheme. Each farmer's application must be treated separately, whether he is to be paid direct or whether the payments are accumulated for payment through the supplier, because the farmer must receive an advice note in either case. The results of the calculations are punched on to cards ready for the preparation of advice notes and payable orders. Other cards are concurrently being prepared containing essential statistical analysis data. The output printer is used for control information during the calculation indicating, for example, an inconsistency between the punched card totals and the totals as shown on the form.

The payable orders and advice notes are prepared on a 902 tabulator with Lamson Paragon dual-speed feed attachment, which produces at the same time copies of selected parts of the data for other uses; for example, as records for the Paymaster-General. The computer has only sufficient alphabetical storage space for 22 letters of information used for the name of the farmer. If the name is longer than this the excess letters must be filled in by a typist from the original documents. There is a standing list of addresses for suppliers but because the number of individual farmers who may receive payment in the course of a year is considered too large either to code each farmer and aggregate his payments or to keep a record for the preparation of addresses, they are each treated as separate items. Farmers' addresses are typed from the original documents. Although the records of payments are never collected together when payable orders and advice notes are being prepared, the cards relating to the payments have, nevertheless, to be filed for each recipient in order to answer queries and to carry out checking routines; for example, where double payment for the same delivery is suspected.

It is characteristic of most of the financial work done by this installation that each certificate is treated as a unique entity. Each time a farm buys fertiliser or, for that matter, sells an animal, the system assumes that he is a new farmer which it has never encountered before. There are, of course, notable exceptions to this procedure, as in the case of large buyers of bacon pigs who

have their accounts treated separately, but this is not the general rule.

Live Pigs Sold by Auction

Each of the 12 categories of fatstock has a different procedure but the guarantee for live pigs sold by auction will illustrate the scheme. The payment is made in accordance with the weight of the animal and the guarantee rate per pound for the week. The rate may vary weekly, because it is the difference between the average market price plus the guaranteed price set for the week, adjusted for the current market price of feeding stuffs, and the standard price agreed at the beginning of each scheme year.

Batches of advice of sale certificates come from over 600 markets in the country. A list of the animals sold accompanies the forms for each farmer which give the number of pigs sold, their weight and the price realised. The first work is to calculate the national average price for the week as soon as a sufficient percentage of the forms are received. The provisional rate of guarantee previously announced may have to be adjusted as a result of this calculation. When the rate of guarantee is set the payments to individuals for their sales can be calculated. Before this is done the forms have been scrutinised and the data punched into cards. The clerks eliminate any non-qualifying animals, but if some are overlooked the computer will complete the job. The computer starts by adding up the individual items and balances them against the certificate totals which have been punched on the cards. It excludes underweight pigs and treats overweight pigs as if they were of maximum weight for purposes of the guarantee, although for statistical purposes their real weight is retained.

The guarantee to be paid to each farmer is then calculated. The calculation is checked by comparing the results of individual calculations and the totals for the auction centre. The number of each centre is printed on the output but only if the totals do not balance is the control information printed. In such a case the identification data is printed together with the figure in which the computer has found a mistake, *ie*. number of animals, selling price, or weight. In In a typical run less than one percent of forms needed scrutiny for such discrepancies. This computer checking system represents one of the major improvements over the punched card system. Batch totals for control purposes were previously established on Comptometers. Two separate tabulations had to be made to balance detail cards from each centre against the totals. These tabulations were scrutinised by clerks and corrections were made. The whole of this procedure is now replaced by checks made by the computer, and the amount of error elimination to be performed by clerks is considerably reduced. Simultaneously, with the major part of the procedure, *ie*. the preparation of payable order cards ready for tabulating—the computer does the calculation of auctioneers' fees and the accumulation and analysis of the details of each application form for statistical purposes. Apart from the control tabulating previously mentioned, the data required for subsequent operations is punched out.

As with the fertiliser payments, the payable orders, which are the equivalent of cheques, and the advice notes are prepared from punched cards on a tabulator. The names which are out of scale and the addresses are typed from the original documents.

When the Paymaster-General's reconciliation information is processed the system makes use of its sole opportunity for integrated data processing. Up to this point data cards have had to be created from original data or by the computer for each function to be performed. For the reconciliation recorded data are re-utilised.

Some of the theoretical expectations of the criteria which would make a computer installation profitable seem to be belied by the Ministry's applications which are nevertheless a success.

The tight time schedules are met, the farmer gets his payments, and the peak of demand for fertiliser payments is overcome with little more than a few weeks' overtime working. In addition, the installation shows some saving over previous methods.

In summarising what makes possible the Ministry of Agriculture, Fisheries and Food installation, three main items should be noted. First, the greater packing density of data on punched cards for some of the computer processing over that for conventional equipment, *eg*. for the fatstock (liveweight) three lines of data per card and fatstock (pigs deadweight) nine lines per card, reduces the number of cards and the number of passages of cards required to perform the same function. Secondly, the use of the computer to do its own scrutiny and checking processes eliminates desk calculators, and reduces punching, while at the same time reducing the clerical effort required for visual checking. Thirdly, the reduction of both machinery and operators: a comparison can be made between the cost of the rentals involved in doing the job with several punched card machines and the associated cost of their operators, and the cost of the computer which replaced them. These economies, together with a more efficient system, are the main justifications for the changeover to computers.

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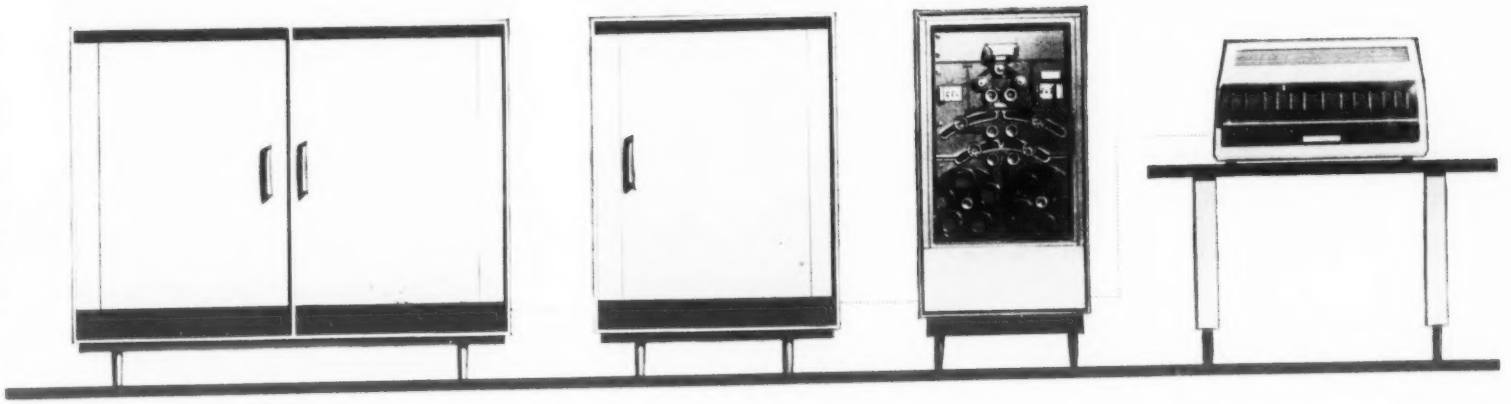

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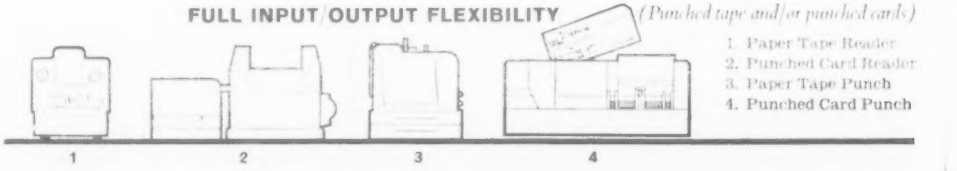

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⁂ This is the First of a Series of Announcements Covering New Developments in NCR Computers

THE COMMUNICATIONS PROBLEM

Continued from page 16

Transmitters are made in different patterns according to whether they read 8-channel perforated paper tape and edge-punched cards using a similar code, tabulator cards punched with a Hollerith code, or 'form cards'—a larger version of an edge-punched card. At the receiving end data from all these media emerge in the form of 8-channel paper tape. A time-code emitter can be connected to any receiving punch where it provides a 5-digit time indication which is punched automatically into the receiver tape.

Alphabetical and numerical information can be read by the transmitters. For entering additional variable details there is a series of dials which provide capacity for up to 18 digits.

The system is designed for use by untrained operators. The design of the output stations precludes transmission if a card is incorrectly inserted or if, in the case of a two-card transmission, the sequence is wrong. A 'busy' light indicates if the line is engaged. In this case, the operator sets the machine in the 'start read' position and leaves it, transmission taking place automatically when the line is free.

Prefabricated Parts Control

One of the American users of the Collectadata system is the Cessna Aircraft Company, manufacturers of business aircraft, military equipment, industrial products and electronics equipment. Their problem, as may be imagined, was to keep tabs on their parts supply position so that fabrication parts were always available at the installation area. They needed:

to know at any time the exact location of all open production orders in fabrication shops;
an efficient expediting system so that needed materials were readily available;
a good reporting system which would warn them in ample time that a shortage of parts was likely to occur.

Their Collectadata system has provided a means for collecting these multifarious details at a central despatch point which immediately records movements of all production orders and gives item numbers, due dates and locations to the fabrication shops, stockrooms and so forth.

Cessna uses two systems, one with six transmitters, the other with seven. Each is connected to its own receiver in the central despatch office. There is also a special connector which can link the two systems together—a necessary step if one transceiver temporarily goes out of action. A tabulator card is prepared for each production order and accompanies the material through each stage. As it moves from stage to stage, a record is sent to central despatch through the Collectadata transmitter, the department number, group number, machine number and transaction identification (status of the order) being entered by switches on the machine.

At intervals during the day, the despatch department clerks put the receiver tapes through a converter, which translates them into punched cards. These are filed and provide a progress report on all current work.

From this deck of cards, a daily list of current material shortages is made. This allows the scheduling department to keep constant control over the flow of materials, and to anticipate shortages; it immediately notifies them if any manufacturing problems arise.

Other reports provided by the system include non-movement, overdue, priority, and group machine loading.

The Ferranti Transactor

This system is basically different from those described previously, in that it presupposes the use of a computer. It comprises any number of interrogation stations, which may be situated at any distance from the computer, and from which information is obtainable at random from the central unit. Developed in the first instance for Trans-Canada Airlines, who needed a quick method for checking the availability of seats in aircraft from any town in the country, it may equally well be applied to operations in retail stores and mail-order firms, to controlling manufacturers' stocks, or to any other instances where immediate answers are required.

The Transactor station is a box measuring 20½ by 13½ by 8½ inches. To enter a query or an instruction, the operator uses a card, similar in size to a standard 80-column punched card. In the case of Trans-Canada Airlines, the queries are all connected with aircraft reservations. The card is therefore marked to include classes, journey details, dates and flight numbers. The clerk marks the card in accordance with the query and inserts it into the Transactor. The machine *senses the marks* on the card and transmits the information it obtains to the computer, which searches its files. The answer is indicated by whether the Transactor punches a notch in the 'yes' or 'no' position on the card. The time which elapses between insertion of the card and receiving of the answer (signified by automatic release of the card and indicated by a warning light) is about 4½ seconds.

A total of 286 positions is available on the

Transactor card, in all of which pencil marks can be made. The answering notch may appear in any of 12 positions or in a combination of two or more, thus offering a wide choice of replies.

Transactor stations are connected to the computer by telegraph or telephone lines which, in the first instance, are channelled to a local distributor. This is a data transmitter-receiver to which many Transactors can be connected by a single cable. As, however, the maximum total length of cable allowed between one Transactor and the local distributor is 300 feet, in practice it is necessary to have a distributor to each station.

Though, at present, the Transactor is designed to operate with a Pegasus computer, it could work with any digital computer which had sufficient storage capacity and a short enough access time to return the answers satisfactorily. The system need not be used exclusively for interrogation, but can also accept instructions for updating the computer's records.

Teleprinter Transmission

Teleprinter automatic data transmission systems have been with us for so long that it is easy to forget their existence or to underestimate their importance. As was explained earlier, the willingness of the Post Office now to accept codes other than the international telegraph has considerably extended the usefulness of the system for computer users.

A growing number of companies use teleprinter links for "straight" communication on private lines between head and branch offices and for transmitting invoices and similar day-to-day documents from point to point. One organisation which is using the public Telex network to very good advantage is the Bank of Scotland, which now transmits, by teleprinter, information on its customers' accounts from a number of branches in various districts.

The bank at present employs a standard punched card accounting system at its head office on which records are kept of transactions made both at that office and at a number of outlying branches, of which the Oxford Street, London, branch is typical.

As soon as the day's business begins at Oxford Street, details of transactions on customers' accounts are entered on the keyboard of a standard GPO teleprinter, which simultaneously produces a punched paper tape. Details entered include the account number, amount, and whether the entry is a debit or credit. As soon as sufficient data have accumulated to make a transmission worth while, a Telex call is made and transmission occurs direct from tape at a speed of 400 characters per minute. These transmissions are continued at intervals until the close of business, since it is easier for the head office to receive several batches than one large chunk at the end of the day. As each batch is entered at the branch end, a total is made. This is used later for checking purposes.

At the head office end, transmissions are punched out on a similar 5-channel tape, which is run through an IBM tape-to-card converter. This produces a card for each entry transmitted from the branch, including one for batch totals. The cards are passed through a machine which verifies the account numbers, accumulates a total transmitted from the branch. The verified cards are then processed through the tabulator in the normal way.

Using this method, the Bank of Scotland can carry out a fully automatic accounting operation at one central point for all its branches on the Telex system. The tabulator produces slips showing the transactions on each account. These are sent to branch managers each night by post, so that up-to-date records of individual accounts are available the following morning.

Ferranti's Transactor system starts and ends with this box. A query card is inserted—the same card gets a notch punched out of it four and a half seconds later to give the answer

WHAT'S NEW

in systems, services and equipment

Electronic Storekeeper

IN times of mass production methods and multi-item stores, storekeeping become problematic. Annual stocktaking, snap checks when surges of incoming orders are anticipated, stock checks against forward ordering, and so on, each set their own particular problems.

Electronic Machine Co Ltd have for some time now been working on the problem of producing a specialised computer, an electronic 'storekeeper' that would fulfil all the functions of large computers with stock control programs and yet be within the scope and pocket of the many smaller organisations who are not in the computer class. They have developed a machine that can record up to 50,000,000 items under 5,000 different headings.

The basic model is priced at £4,750 and takes up no more space than a large desk. Initiating records in the machine is done through the medium of a permanently incorporated electric typewriter which has been specially adapted for this purpose. The typewriter is also available for typing all associated information on such documents as goods inwards or outwards advice notes, invoices and works issuing dockets, etc. The machine illustrated below is the basic model which is capable of storing 10,000 articles under each of 5,000 different catalogue requirements and are obtainable in multiples of 10,000 and 5,000 respectively.

Operation is simple. By pressing the initiation tab and the plus or minus tab followed by the catalogue number, the *recording drum* is prepared for the acceptance of the quantity of articles to be added or subtracted, the manipulation of the following keys causing their number to be recorded.

Two things then happen: a row of illuminated digits on the top display panel will show the quantity of goods then being placed in or taken out of stock, and the lower line of illuminated digits on the other display will show the number of items in stock under that particular catalogue heading *before* the new stock movement is recorded.

The 'storekeeper' then calculates the new stock position and the electric typewriter comes into operation, and gives a typed record of these figures on the form that will have been inserted and for this purpose one half only of the platen is used, the second half being available for documentary typing.

Querying what stocks are held under any or all of the catalogue numbers can be done by the use of the appropriate tabs and keys, each answer coming up on the lower line of illuminated digits whilst being typed on the stock form.

This equipment should be useful in businesses where continuous and large-scale turnovers in stock create problems. Other applications for the 'storekeeper' might be found in theatre and travel agency businesses where many branches are continuously telephoning situation reports.

Electronic Machine Co. Ltd.,
Mayday Road,
Thornton Heath,
Surrey.

◀ Information is stored on a drum in the 'storekeeper'

Point-to-point Data Link

EQUIPMENT which enables any form of binary data to be transmitted over the normal Post Office telephone system (either private line or ordinary subscribers' lines), at a rate up to about 1,000 bauds, or at about 500 bauds when using an error-correcting code, has been developed by Ericsson Telephones. Facilities are provided for switching over to the equipment after a call has been established in the usual way by telephone.

In the standard form, data are fed into the equipment, known as Digital Data Link, on five-hole punched paper tape by means of a special reader but provision may be made for other forms of input.

The received and decoded signal may be read out either serially or in parallel form.

Due to the fact that on subscribers' lines, and to a lesser extent on private lines, interference bursts of a length equal to several bits of information occasionally occur, it

is found that for most applications an error-correcting code is necessary.

The code used is completely serial in action, a parity check bit being inserted between each information bit. A two-bit synchronising signal is also introduced between each block of 10 information and check bits.

Using this system, error bursts of up to 10 bits in length can be corrected provided that the signal is error-free for a subsequent 31 bits.

By only a small increase in complexity, the equipment can additionally indicate the occurrence of error bursts greater in length than 10 bits. Alternatively, longer error bursts may be corrected but only at the expense of increasing the necessary number of error-free bits between error bursts.

Description

At the sending end the equipment comprises a tape reader, an error-correcting encoder, and a frequency modulated transmitter.

At the receiving end there is an amplifier and detector, followed by the error-correcting decoder.

The modular construction used provides flexibility in accommodating specific requirements in respect of input and output form, and the degree of error correction needed.

Tape reader

An electric motor drives the tape across the reading head at speeds up to 15 inches a second. The tape is photo-electrically sensed and the information fed out on five parallel paths to the encoder.

Encoder

The information from the tape reader is amplified and transposed into serial form via a shifting register whose shift is synchronised to the tape reader's speed. A parity check bit is inserted after each group of 10 information bits are introduced. The serial output is then fed to the modulation input of the transmitter.

Receiver

The receiver comprises a line transformer, AGC amplifier, resistance-capacitance frequency sensitive networks, transformer coupled detectors and filter networks from which a floating output may be taken, and a limiter and output amplifier providing pulses suitable for feeding into the decoder.

Decoder

The decoder contains a counter driven from a multivibrator whose rate is automatically synchronised to the bit rate of the received signal. The information and check bits are fed alternately into two shifting registers, and by parity checks and a switching circuit, errors which may have occurred on the line are corrected, subject to the limitations already detailed.

The corrected information may then be fed out either serially or on five parallel paths.

Ericsson Telephones Ltd.,
Instrument Division,
High Church Street,
New Basford,
Nottingham.

Low-cost Electronic Machine

AN all-purpose accounting machine which provides instantaneous multiplication in pounds, shillings and pence is offered by National Cash. Known as the Sterling Compu-Tronic, it is a low-priced electronic machine which breaks through the restrictions which a non-decimal currency system has imposed on two of the biggest clerical jobs in British business — payroll and sales accounting.

As soon as the operator has entered the factors on its normal accounting machine keyboard, the electronic unit automatically converts the sterling amount to decimal, does the multiplication, checks the answer and reconverts it to pounds, shillings and pence. The answer is then automatically printed by the machine in the appropriate columns of the documents in the carriage.

The machine can also be made to work out such things as percentages and trade discounts. These are selected by pressing keys or through the action of a pre-set program bar which controls the machine's functions automatically.

The result of extensive research at the company's Boreham Wood laboratories, the machine is priced at around £7,000, is easy to operate and capable of doing the work of a small electronic computer. It also has the advantage of producing conventional printed documents with or without narrative description, which can be referred to and acted on immediately.

To provide information for management control the Compu-Tronic can be coupled, without modification, to an automatic paper tape or card punch. This enables the day-to-day records which it produces to be analysed on punched card machinery or on a service bureau computer.

For the first time the build up of gross pay in firms with complicated piecework or bonus rates can be done on the keyboard machine which actually prints the payroll and payslips. Usually this work has to be handled by a team of clerks. The new equipment reduces two jobs to one operation.

National Cash Register Co. Ltd.,
206 Marylebone Road,
London, NW1.

CONTINUED ON PAGE 46

▼ Electronic multiplying in £ s d

New Logger-scanner

PRODUCTION has commenced in this country of a new logger-scanner system by Honeywell Controls of Greenford, Middlesex.

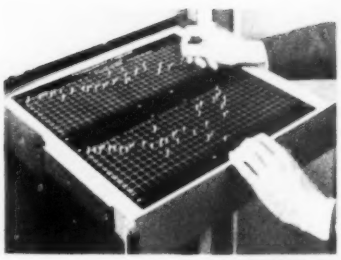
Main feature of the system is that it will accept analogue signals from a wide variety of sources, such as thermocouples, pressure gauges, flowmeters or statistical measuring units, and convert them into very accurate four-figure digital readings which are printed out on an electric typewriter directly in the appropriate units, at the rate of one reading per second.

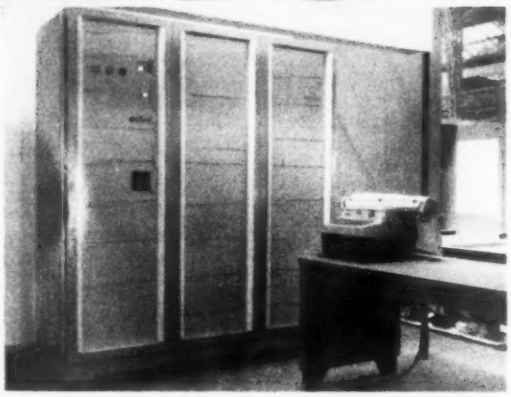
The number of points handled by the equipment is 240, which means a complete log every four minutes. Any point can also be selected for visual display on demand, on an illuminated four-digit panel. The logging interval, which is controlled by a digital clock, can be adjusted to any convenient frequency.

An optional scanning function, which can be interposed between logging cycles, covers all points at a speed of seven per second, and sounds an alarm when any reading is found to be above or below preset limits. Off-normal values are also printed out on tape, with time and point identification. Off-normal points are, in addition, printed in red on the log sheet during logging cycles.

Digital accuracy

Two features of the equipment are especially useful: the first is that the accuracy of measurement is higher than that achievable by analogue means, as used in conventional recording systems. The incoming signals are balanced, not against a motor-driven potentiometer, but against a network of fixed high precision resistors manufactured under laboratory conditions to an accuracy of within 0.02 percent. The resistors, arranged in digital ratios of 5, 2, 1 and 1 for each of the four readout digits, are switched into circuit by a magnetic sequencing switch through mercury-wetted relays which retain a constant contract resistance, and the value is balanced against a Zener diode-supplied standard voltage accurate to within 0.01 percent. The over-all result is that variables are measured within an over-all accuracy 0.1 percent or one digit, whichever is the greater.





Above a programming pinboard and the electric typewriter which prints out the log. The complete (right) system takes up little space

Pinboard flexibility

The second valuable feature of the logger-scanner is the ease with which it can be adjusted to accept different levels of input and to read the values out in the actual units concerned. This is made possible by an ingenious series of pinboards, constructed from laminated printed circuits, on which each input is provided with a series of holes in which pins are simply inserted to make automatic circuit adjustments. One series of holes covers different levels of full-scale input corresponding readout value in the thousands, hundreds, tens and units columns. Adjustments are carried out by the operator in a few seconds; no other adjustment or lining-up is required, and the pinboards provide a clear indication of selected parameters at any time.

The entire equipment is engineered to allow easy maintenance by control room personnel without special instruments. All units are fitted in drawers, and may be inspected while working normally. The sequencing arrangements can be overridden manually to allow examination of each step in the balancing operation. In the event of failure, the plug-in units can be individually replaced with a minimum interruption to normal working.

With its versatility and accuracy, this logger-scanner lends itself particularly to work in process industries and complex test operations where large numbers of variables must be monitored continually. The presentation of the readings, in unusually clear form, simplifies the task of adjusting operating parameters for greater efficiency, and frees control room staff from tedious manual logging, while at the same time eliminating the possibility of human error.

The first completed unit is being installed at the Royal Aircraft Establishment at Farnborough. Other applications expected to follow include power stations and a wide range of processing plants.

Honeywell Control Ltd.
Greenford,
Middlesex.

High-speed Copying Machine

A RECENT report by the science correspondent of *The Observer* refers to the invention by a London industrial designer, Mr. Abram Games, of a machine the size of a typewriter which can produce copies of almost any document at a speed of 60 feet a minute.

With the machine still at the prototype stage, the inventor is at present in contact with several companies.

Compact and fast, the machine

can be used to make single or multiple copies of any black-and-white document, drawing or photograph. Copies can be made in several colours on several materials and the surfaces do not have to be chemically prepared in any way.

The Observer report stated that the cost of this machine is likely to be once it has been developed for commercial purposes—under £200.

Overprinting Machine

A SMALL rotary overprinting machine able to add different details to several labels or tickets simultaneously has been evolved for firms requiring exceptionally long and narrow labels or tickets. This newcomer is known as the Tickomajor and produces, in the office where they are actually needed, labels or tickets of all sizes up to 12 inches long and 6 inches wide.

Motorised slitting-cutters allow the machine to print several labels or tickets side by side on the same reel, slitting the printed web lengthwise to give the tickets whatever width the user requires.

The detail on each of the labels being printed or overprinted alongside does not have to be the same. Different detail may be added to the labels in each 'strip' on the web. Using handset type, slugs, plates or stereos, the Tickomajor's type drum permits up to 60 lines of type to be printed or overprinted on a 12-inch label.

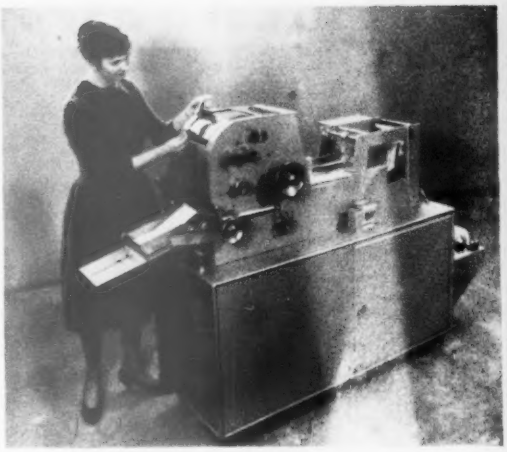
A guillotine, with a traverse of six inches, automatically snips off the printed labels or tickets, and the machine attains a speed of 150 impressions a minute. A high degree of inking efficiency is achieved by the ink distribution system, replenished by means of an ink-duct.

The controls are sited together on a panel on the left-hand side of the machine; all operations, other than threading the reel of paper and making adjustments, are fully motorised.

This automation gives the operator freedom to set the type for other labels whilst one batch is being run-off.

Arranged alphabetically and numerically in trays, the type is moulded with 'feet' that permit it to be slid into a special composing stick and thence into channels on the machine's type drum. A line of type is set in a few seconds.

With over-all length of seven



and half feet and width of four feet three inches the machine stands on a neat metal cabinet—offering cupboard storage space for accessories and reels of labels—and is fitted with wheels to make it mobile.

Price for the basic machine without attachments is £1,450 with delivery, at present, up to seven months.

Tickopres Ltd.,
7-8 Old Bailey,
London, EC4.

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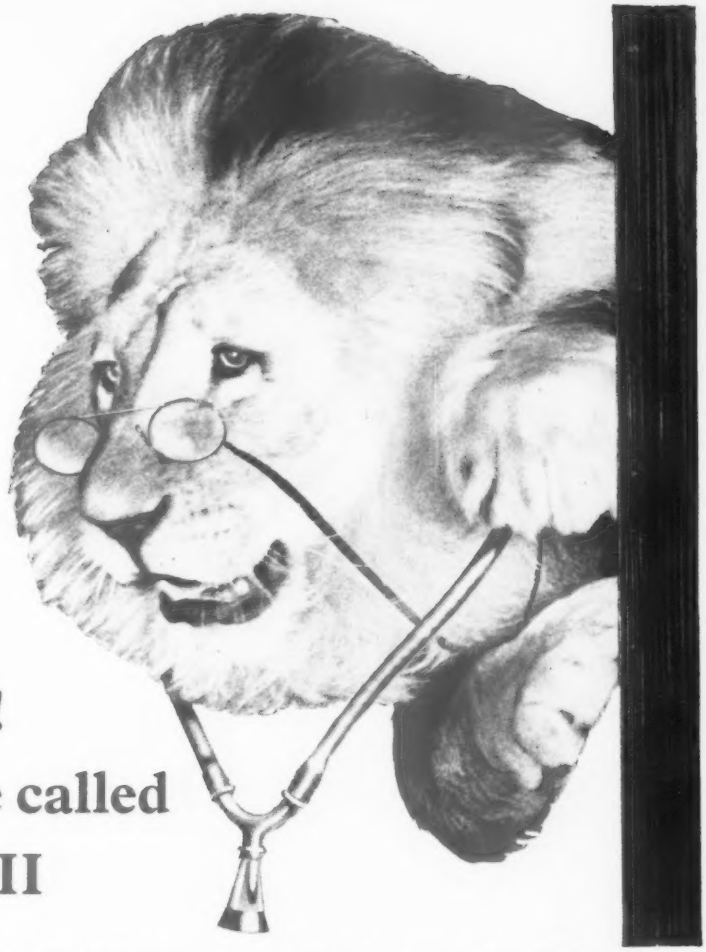

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